

2006

Agricultural extension educators' perceptions regarding the teaching and learning process related to water quality issues in the North Central Region of the United States

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**Agricultural extension educators' perceptions regarding the teaching and learning
process related to water quality issues in the North Central Region of the United
States**

by

Mohamed Camara

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY

Major: Agricultural Education (Agricultural Extension Education)

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2006

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For the Program

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ABSTRACT

The North Central Region of the United States is the largest grain producer in the world. Therefore, the soil is intensively exploited which will eventually affect the water in this region. Most of the states in the NCR border the Mississippi River, thus contributing to the quality of water in the Gulf of Mexico. A review of related studies indicated a lack of suitable educational programs to assist farmers, communities, and extension agencies in understanding issues regarding water quality issues. However, these past studies did not focus on agricultural extension educators' perceptions regarding the teaching and learning process related to water quality issues.

The purpose of this research was to determine agricultural extension educators' perceptions regarding the teaching-learning process focused on water quality issues and related to agricultural practices, additionally the study sought to identify the relationship between agricultural extension educators' perceptions and their motivation for learning about water quality. The study targeted 300 agricultural extension educators randomly selected to take part in the study in the N C R of the United States. Findings were based on 213 completed questionnaires, and non-response error was controlled enabling findings to be generalized over the population.

Availability of time was the most limiting factor for agricultural extension educators to learn about water quality. Agricultural extension educators were more driven by intrinsic factors; they, themselves, were the driving force that motivated their extension work.

Results of this study indicated that the most established source of motivation was self-concept, which implies agricultural extension educators in the NCR are inner-directed

and work according to their own beliefs regarding their best direction. Agricultural extension educators were highly motivated by their personal standards, enabling them to achieve higher levels of competence. This does not imply that they do not need reinforcement and recognition for good work; rather, self-concept implied a greater personal motivation.

This study did not place more emphasis on the training of agricultural extension educators in the North Central Region. Rather, it sought to provide a basic direction for future study in this region of interest.

CHAPTER 1. INTRODUCTION

Background of the Study

Current farming practices have resulted in pollution from fertilizers, pesticides and agricultural wastes. Concern over the nation's water quality has led decision makers as well as citizens to take the initiative to protect surface as well as ground water from pollution by fertilizers, pesticides and agricultural wastes (Dale & Somersan, 1992, p. 3). Responding to this initiative, the U.S. Department of Agriculture (USDA), and Iowa and its local collaborators launched a national Water Quality Program in 1989. Bruening et.al (1992) stated:

... understanding the communication process between educators and farmers must include the context in which farmers live, operate, and make decisions. ... Historically the approaches to agricultural changes have tended to treat farmers' methods of gaining information as a closed system. However, it has become more obvious that farmers' systems of information acquisition and decision making are involved with linkages in a broad social context. Effective communication requires a thorough knowledge of the linkages which affect decisions. (p. 34)

The Water Quality Program was conducted to understand the changing needs of the growing population, such as by home owners who farm, departments of transportation, golf courses, etc., who use fertilizers and herbicides abundantly, which have impacted negatively on the quality of the nation's water resources. To focus on these issues, the United States Department of Agriculture (USDA) has initiated five comprehensive projects to evaluate and develop profitable cropping systems to safeguard water resources. In the Midwest, the Management Systems Evaluation Areas (MSEA) maintains study areas in 10 sites in Iowa, and 3 sites in Minnesota, Missouri, Nebraska, Ohio, North Dakota, South Dakota, and Wisconsin (Giebink, 2003, p. 4).

The focus of the MSEA program is the close integration of research and extension education activities. This program embraces a strong collaboration among the five states coordinating the project. According to MSEA, research and educational programs continue to provide and assist diverse audiences in the agricultural community through more than 700 educational programs that feature activities such as demonstration and new technology and strategies which encourage adoption of cropping practices to reduce the impact on the region's water resources. According to Fliegel (1984), "Educators must utilize models which enhance the information-transfer capabilities of information flow" (p. 34). "The educator, to be effective, must know the social situation, physical conditions and infrastructure of the individual farmer" (Lionberger & Gwin, 1982, p. 20).

The U.S. Geological Survey (2004) defined water quality as, "a term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose" (p. 7). Water quality is an alarming issue in the North Central Region of the United States. Public concerns focusing on nitrate, pesticide and other chemical contaminants continue to be at the forefront, and are beginning to influence public policy (Lichenberg & Zimmerman, 1999; Napier & Trucker, 2001; Kaplowitz & Kerr, 2003). In a recent study, 90% of Illinois residents agreed water quality was the number one issue facing their community (McDonald et al., 2003).

Hallberg (1986) noted that in the Corn Belt nitrogen application has increased rapidly, from 45 pounds per acre in 1965 to 143 pounds per acre since 1986 to meet increased demand for agricultural products. According to the Freshwater Foundation (1987), more than 90% of fertilizer is used by farmers to grow corn and soybeans in the Midwest, which negatively impacts the quality of water. The remaining 10% of these contributors

include golf courses, lawn care providers, and departments of transportation, industries, and home gardeners.

Issues influencing water quality will dominate public policy debates in the coming years, particularly where agriculture other industries are the main occupation. According to Bruce (2003), the United States Department of Agriculture and cooperating state agencies work in partnerships in developing program goals to provide farmers and others with the knowledge and technical means to independently and voluntarily address farming and environmental concerns regarding state water quality requirements, while maintaining agricultural productivity and profitability.

Water consumption is increasing worldwide, and finding clean water is becoming increasingly difficult for people. According to <http://www.thefreedictionary.com/water>:

...water is the most remarkable substance. Although we drink it, wash, fish, swim in it, and cook with it, although probably not all at the same time but educating people how to protect it, to conserve it and how to use it properly is becoming the most challenging issue that the world is facing in this present century. (p. 1)

During the past several years, numerous researchers have attempted to address these and related concerns. Unfortunately, most of the proposed solutions focus on the effects of agricultural practices on the environment rather than the solutions to such problems through educational efforts. Perhaps the most important factor often ignored is educating farmers about environmental issues related to water quality. The National Task Force on Extension Priorities included water quality as one of eight key issues for extension programs (U.S. Department of Agriculture and Extension Service, 1988). Water quality was the dominant issue for the fiscal year 1992 by the National Committee on Extension, Agricultural Research, and Northeast Regional Council (Joint Council on Food and Agriculture, 1990).

According to the Agricultural Research Council, agricultural extension educators are concerned about the means to deliver efficient and effective educational information on environmental issues.

Current research has attempted to address several of the steps which challenge decision makers and agricultural extension educators to view the educational process as a viable way to address this problem. According to Krauss et al. (1979):

Adult experiences serve an important adaptive role in the adult's relationship with the environment, when adults find themselves in totally unfamiliar settings, their perceptual abilities may be "overloaded" with trying to integrate too much information at once ... the maximum perceptual performance, for adults of any age, can be expected to occur when the environment allows for reliance on the past experiences for compensation through use of an alternate sensory system. (p. 25)

Statement of the Problem

A review of past studies (U.S. Department of Agriculture and Extension Service, 1988) revealed that public, governmental agencies and the scientific community have recently expressed concerns about the effects of agricultural practices on the environment as well as quality of life in general. During the last decade, several researchers have attempted to address these and related concerns. However, most of the proposed solutions have addressed the effects of agricultural practices on water quality rather than provide solutions to such problems through educational efforts. Perhaps the most important factor often ignored is educating farmers and communities about water quality. Little or no attention has been given to extension agents' perceptions regarding the teaching and learning process focusing on water quality. Perceptions play an important role when addressing human behavior (Pittenger & Gooding, 1971).

Another concern is that fertilizer and pesticide use have increased not only because of the exploding population, but also because crops and food are grown for export to other countries. According to Bruening and Martin (1992), “to promote a more sustainable environment for growth, agricultural and extension education has a responsibility to not only help disseminate new technology related to environmental and conservation issues but also ensure that appropriate delivery systems be used to enhance the utilization of the technology” (p. 53). This statement places emphasis on the importance of understanding agricultural extension educators’ perceptions regarding teaching and learning behavior in connection with water quality practices. There is insufficient information about agricultural extension educators’ perceptions about the teaching and learning process regarding water quality issues; therefore, the educational process has been the focus of this study.

Purpose and Objectives of the Study

The main purpose of this study was to determine the perceptions of agricultural extension educators in the North Central Region regarding the teaching-learning processes related to water quality educational practices, and to identify the relationships between agricultural extension educators’ perceptions and their motivation for learning about water quality education. The study sought to draw implications for designing an in-service training model for agricultural extension educators focused on water quality practices.

The specific objectives of the study were:

1. Describe the demographic characteristics of the population;
2. Determine agricultural extension agents’ perceptions regarding the principles related to teaching-learning processes focused on water quality issues;
3. Identify effective teaching tools and methods for providing education regarding agriculture practices related to water quality issues;

4. Identify the factors that limit agricultural extension educators learning about water quality practices;
5. Determine the extent to which specific factors influence agricultural extension agents' motivation for extension work;
6. Determine the relationship between the agricultural extension educators' motivation for work with factors that influence decision for work and some demographic;
7. Determine the relationship between the agricultural extension educators' perceptions about water quality issues and their level of motivation to learn more about water quality; and
8. Develop an in-service training model for agricultural extension educators that focus on water quality issues.

Need for the Study

The North Central Region (NCR) of the United States is challenged with intensive agricultural production which has raised concern about water quality issues due to the lack of educational programs to help people involved with farming.

Nevertheless, there is a growing and alarming concern about water quality which has led to increased attention and interest in taking action regarding water quality issues related to intensive agricultural practices in the region.

Some of the questions currently asked are:

1. Who should be responsible for diffusing information concerning water quality related to agriculture practices?
2. What are effective approaches to train agricultural extension educators to deliver new technology and water quality practices?
3. What are the agricultural extension educators' perceptions regarding teaching and learning about water quality agriculture practices?

The answers to these questions could be useful to determine appropriate in-service activities that could be used in teaching and learning about water quality.

The development and delivery of an extensive water quality education program requires collaborative efforts among citizen groups including the 12 states in the North

Central Region, particularly those sharing borders along the Mississippi River. These educational components will be helpful in the long- or short-term future for improving water quality in the North Central Region, such as in citizen voluntary programs, non government organizations, etc.

According to Tennant and Pogson (1995), investing in the learner's experience is an important part of the tradition that places the learner at the center of the education process. Thus, the method of educating the population is important because it must be relevant to the needs of the people, especially in specific geographical areas.

Dewey (1963) and Freire (1972) contrasted highly formal, subject-centered and teacher-centered education methods with those that take the experience of learners as an essence of success. Borger and Seaborne (1982) perceived "learning as any more or less permanent change in behavior which is the result of experience" (p. 14). Hilgard and Atkinson (1967) defined learning as, "a relatively permanent change in behavior that occurs as a result of practice" (p. 270). However, this attempt to defend the definition of learning might compound the problem, since learners may assess their own learning, which may actually be far more accurate than any of the present methods of assessment utilized in education (Jarvis, 1987).

Who is in charge of diffusing national water quality programs? The U.S. Cooperative State Research Education and Extension Service (CSREES) water quality program provides leadership in extension education mainly to enable farmers, industries, and government to make changes and protect the national water resources for the public good (USDA CSREES, 2003-2004). What are the effective approaches to teach agricultural extension educators about water quality amelioration practices? What are the agricultural extension educators'

perceptions regarding teaching and learning about water quality amelioration practices? This information could be very essential in determining suitable in-service activities to be used in teaching and learning about water quality issues.

Implications and Educational Significance

This research sought to assess agricultural extension educators' perceptions regarding water quality issues and identify their perceptions regarding the teaching-learning process related to water quality issues in agriculture. This knowledge can be used to address agricultural extension educators' concerns related to teaching and learning about water quality issues. Findings of this study could be used for the development of in-service training programs for agricultural extension educators on water quality issues.

Limitations of the Study

The current study used a survey instrument to gather information from a target population of 300 extension education professionals in 12 states contributing to the depletion of water to the Mississippi River and the gulf of Mexico also the regarding perceptions of water quality education provided to inhabitants whom they serve. Thus, the findings of the study might not be generalized to other populations.

Definitions of Terms

The following terms were defined for use in the study:

Adult: "a person who has come into that stage of life in which he has assumed responsibility for himself and usually for others, and who has concomitantly accepted a functionally productive role in this community" (Verner, 1964, p. 29).

Agricultural Extension Educators: The county level agricultural extension educators who are responsible for agricultural and natural resource extension education programs in the cooperative Extension Services of the U.S.A.

Cooperative Extension Service: The extended public education and information service operated by land grant universities.

In-service Training: Training provided for someone during employment.

Learning: “Learning is a change in an individual, due to the interaction of that individual, and his/her environment, which fills a need and makes him/her more capable of dealing adequately with his/her environment”. (Burton, 1963, p. 52).

Motivation: Motivation is the internal force which gives direction and intensity to behavior of an individual.

North Central Region of the U.S.A.: The region comprised of the twelve states, namely, Illinois, Indiana, Iowa, Kansas, Michigan, Missouri, Minnesota, South Dakota, North Dakota, Wisconsin, Ohio, and Nebraska

Nutrient: Element or compound essential for animal and plant growth. Common nutrients include nitrogen, phosphorus, and potassium.

Perception: A personal view or judgment about a phenomenon, issue, activity, method, or practice.

Practice-based standard: Process that does not give flexibility to producers in the way of choice of practices/systems to use; there are some issues/concerns that need to be overcome (USDA-CSREES, 2003-2004).

Performance-based standard: Acceptable level sought (i.e., meeting water quality criteria), which gives some flexibility to producers in the way of choice of practices/systems to use;

there are some issues/concerns that need to be overcome such as climatic condition, soil type, geographic situation etc. (USDA-CSREES, 2003-2004).

Teaching: Teaching is the process by which a person facilitates learning by others.

Training program: “A series of learning experiences designed to achieve, in a specified period of time, certain specific learning objectives for an individual or a group of learners” (Verner, 1964).

Teaching tools: A device used for facilitation of the learning process.

Water quality: A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

CHAPTER 2. REVIEW OF LITERATURE

This chapter presents a review of the literature on water quality, environmental education search related to extension education. The literature review focuses on: (1) the need for water quality education in the North Central Region; (2) the meaning of water quality education and public issues; (3) the history of water quality association; (4) constraints to learning about water quality; (5) the conceptual framework for the teaching and learning process as it relates to agricultural education; (6) adult motivation for learning; (7) the perception and human behavior; and (8) information from past studies related to water quality and extension.

Need for Water Quality Education in the North Central Region

Water quality education is becoming an increasingly important focus for educational research in extension a professional context. This study reflects a real world situational problem on water quality issues and educational research paradigms and these are the reflection in defining water issues education. "Education about environment which includes water quality is concerned with providing cognitive understanding including the development of skills necessary to obtain understanding" (Lucas, 1980/81, p. 33)

The influence for public education on water quality issues will have a positive impact on the future water quality. Effective and meaningful water quality education is a challenge that should be taken seriously for future generations to understand and preserve their natural heritage. This study identified several of the current and future challenges to water quality education in the in the NCR and offers suggestions on how to best to address them. Although some of the examples and education models involve agricultural extension educators, the

concepts behind the educational strategies can be applied to most water resources settings. Some of the information presented in this research may be applicable in other states struggling with the challenges of water quality education. To accomplish the main objectives in this study regarding water quality education, it was important to determine: (1) what motivates agricultural extension educators to learn more about water quality issues in the NCR; and (2) what are the best educational process to successfully deliver the best learning outcomes. The answers to these questions in a preliminary pilot study were used to provide the rationale for conducting this research.

Water quality education and issues in the North Central Region have been critical for the past two decades despite numerous federal and state programs to improve water quality in this region. Thus, the current study could be applied, for example, to uncover a potential source of hypoxic water found in the Gulf of Mexico by understanding the imbalance in the habitat along the Mississippi River which feeds into the Gulf of Mexico via the NCR. Despite extensive farming programs in this region, the quality of water remains precarious. The main reason for this research was to understand the level of knowledge by agricultural extension staff of water quality issues as well as their perceptions of how to communicate successfully with people who impact the water quality in the NCR. If a gap exists, then a plan to provide an appropriate educational program to agricultural extension educators operating in this region could be developed to help them work with their constituents who farm in the Mississippi River watershed. Such a plan could be developed to address specific, differing concerns in locations throughout the North Central Region. Specifically, agriculture education specialists can be educated to focus not only on the water quality needs of a

specific area but also understand how to work with the people living and farming in communities in the NCR. According to Hudson (2001):

...environmental educators must come up with new knowledge and techniques that address the demands of a constantly evolving social and technological landscape, while ensuring that environmental education stays relevant to the needs and interests of the community. These challenges to environmental education require that we reexamine the way we do research and train environmental professionals and educators, as well as the way we communicate environmental information to the general public.” (p. 283)

As a consequence of a lack of educational programming and declining quality of water in the NCR, there is a growing concern about the threat of excessive application of chemicals to fulfill production and current practices that affect the quality of life (Padgitt, 1987). Over several years of water assessment data in this region, the Environmental Protection Agency has detected traces of 17 pesticides in the groundwater in 23 states bordering the Mississippi River. The chemical found in the greatest quantity is the corn herbicide, atrazine. Research conducted in this region has shown that herbicides in drinking water can cause serious health problems (Freshwater Foundation, 1987; Halleberg, 1986).

The cooperative extension water quality programs in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Ohio, and Wisconsin have formed a partnership with the Region 12 Environmental Protection Agency and the states’ water resources research institutes. The partnership provides a framework for these organizations to work together cooperatively to provide research-based education to communities in order to help them protect or restore the quality of water resources.

In the past 10 years, Iowa State University Extension has been part of numerous water quality special projects. These projects have been funded by both state and federal programs for targeted areas throughout the state, wherein water resources are threatened by

agricultural non-point source pollutants. Extension's role has been to demonstrate refined management practices and deliver education programs about effective management methods that reduce potential agricultural pollution while maintaining farm profitability. As soil and nutrient management are refined, profitability is often enhanced. A series of extension reports by ISU extensionists have provided information and education regarding Iowa's water quality projects, and how farmers have successfully applied this knowledge to protect the land and water in the state of Iowa.

Several researchers have focused on water quality education in the NCR and are willing to expand more research in the coming years. According to Sigmon (1996), "...we are faced with the reality that traditional disciplinary approaches to problems solving will not in addressing the critical environment issues of today" (p. 206). The Committee on Inland Aquatic Ecosystems (CIAE) within National Academy of Science recently published a report recommending that administrative and curriculum reforms should focus on educating responsible citizens about stewardship of aquatic resources and training the next generation of scientists to help develop the knowledge necessary to reverse the damage done on water bodies, particularly educating students to understand the interdependency in the environment and build connections beyond the world of learning (CIAE, 1996; COSEUP 1995; Good & Lane, 1994; Greene et al., 1995).

We know this place, and these crises are familiar, but the feeling is not one déjà vu. Things have changed, and the changes call for redouble learning and exploration of new ethical, political, economy and educational paradigms, the current debate and the interface between environmental survival and the role education is disappointing. Whether education as a whole can be bold enough to develop an adequate response, on a scale commensurate with the issues that have to be addressed over the next decade, remains a crucial question. (Sterling 1992, pp. 1-2)

Extension professionals as well as government agencies, universities and the farming communities in the NCR should use a well-developed strategy to overcome barriers that threaten water quality in this region. The term “strategy” as suggested by Williams (1991) refers to combining and employing means on a broad scale for gaining advantage in war. Perhaps this term is appropriate, considering that agricultural education is (as are some other disciplines) experiencing some self-defeating tactics (Williams).

The next subsection presents several initiatives taken to address water quality education regarding the critical situation in the NCR. Curriculum theories are presented that provide learners and agricultural extension educators a means to address water quality education.

Water Quality Education and Public Issues

According to outcomes of the USDA CSREES National Water Quality Conference in 2003-2004, the Best Education Practices program should be used to help natural resource management and outreach professionals to select appropriate education techniques and resources for their water management programs. It should be, “A program or practice that has been clearly defined, refined through repeated delivery, and supported by a substantial body of research” (p. 15).

Community and public issues education enables citizens and their leaders to obtain and use information in initiating, implementing and influencing collective actions to address common problems (Dale & Somersan, 1992). The main purpose is to adapt, address, and implement policies that are effective in dealing with the issues and threats to the common welfare. Public issues education focuses on the difficult, and sometimes contentious, choices faced by governmental agencies, businesses and individual citizens (National Public Policy Education Committee, 1994). Public issues education is related to overlaps with public policy

education, which applies knowledge of the university to public issues and educates citizens to enable them to make better informed policy choices (Barrow, 1987).

The public issues education component of the targeted program has focused on extension services in the 12 states in the North Central Region of the U.S. The goal has been to inform public officials, community leaders and citizens about water quality problems of communities and watersheds and alternatives for addressing such problems. The National Extension Targeted Water Quality Program (1992-1995, p. 2) has revealed that some states acknowledge only education for public or broad public information distribution efforts. The Plan of Work (POW) disclosed that extension staffs in some states were not dealing with water quality issues despite the purpose of extension education to increase awareness of water quality problems and potential management responses for communities and watersheds.

According to Cox, Lawver, Baker, and Doerfert (2005, p. 24), in the eight states in the Ogallala aquifer, agricultural educators teach several curricular topics related to agricultural education in their science classes. Teams work together to assemble the curricular topic information regarding state standards that are designed through the collaborative efforts of teachers, administrators, and state Departments of Education. In the same aquifer, the Wyoming Vocational Agricultural Teachers Association has proposed to include the following options in their school curriculum: “(1) conducting water quality tests and identifying contaminants, (2) discussing water as a nonrenewable resource, (3) supply versus demand, (4) aquifer mining, and (5) interactions between federal, state, and local acts that effect water, such as the National Clean Water Act.” (Cox et al., 2005, p. 24).

A proposition from Texas in 1998 requested to put more emphasis on the:

...implementation of essential knowledge and skills to be taught in the classroom. Curricular standards that address natural resources included: (1) determining the importance and scope of natural resources, (2) defining the impact that natural or water resources have on the agricultural industry, (3) analyzing conservation and environmental water policies related to the local, state, and national levels, and (4) developing management skills for natural resources. (Cox et al. 2005, p. 24)

In 1999, the Nebraska Department of Education recommended placing more emphasis on “natural resources that can addressed as cited: (1) identifying and suggesting strategies to properly manage water resources, (2) distinguishing local and state water supplies for domestic, commercial, and industrial use, and (3) describing the various elements, which can affect water quality and quantity” (Cox et al., 2005, p. 24).

In 2001, the Colorado Department of Education (CDE) suggested their curriculum should focus on: “(1) conducting water quality tests, and determining what contaminants are present, (2) demonstrating knowledge of legal and administrative structures, which affect water resources and management, and (3) dealing with water regulations at the local, state, and federal levels” (Cox et al., 2005, p. 24).

In 1999, the Kansas Department of Education (KDE) suggested to focus on:

“issues related to natural resources to be taught in the classroom: (1) identifying the roles and interactions between humans and the environment, (2) understanding that groups hold different views on environmental issues, (3) describing ways that economics and politics can affect decisions about the environment, (4) explaining human rights, economic development, public health, resource allocation, and environmental quality, (5) describing the short and long-term costs and benefits of addressing local, state, and national environmental issues, (6) illustrating how technological advances have changed the way people interact with the environment, and (7) identifying ways in which various resources can be reused and recycled. (Cox et al., 2005, p. 24).

North Plains Groundwater District /Department of Career and Technology Education proposed that “agricultural education give more importance to the principles and processes

involved in conserving and/or improving natural resources, such as air, water, land, wildlife, habitat, forestry, and energy for economic and recreational purposes. Broadly speaking competencies include the establishment, management, and operation of land and water” (Cox et al., 2005, p. 24).

According to Career Clusters in 2002, the topics taught in New Mexico in agriculture, food, and natural resources should focus on:

(a) identifying the components of each agriculture, natural resource, and environmental system to address their maintenance requirements, (b) recognizing the importance of resources and human interrelations, (c) using effective venues to communicate natural resources to the public, (d) communicating natural resource information to the general public, (e) using the science concept processes and research techniques to examine natural resource topics, (f) practicing responsible conduct to protect natural resources, and (g) identifying policies and regulations impacting the environment. (Cox et al., 2005, p. 24)

In South Dakota, classrooms include curriculum program topics such as, “(a) identifying surface and groundwater supplies, (b) calculating water needs on farms and in rural communities, (c) interpreting water use laws and rights, (d) determining water quality standards, and (e) conducting water quality tests” (South Dakota Agricultural Education/FFA/PAS, n.d., as cited in Cox et al., 2005, p. 25).

The problem is that the states all have different interests and independent legal systems encourage officials to pretend as if the Ogallala aquifer were bounded by their state borders (Verchick, 1999, as cited in Cox et al., 2005, p. 25). Ignorance and carelessness are the principal factors for water quality deterioration (Guru & Horne, 2000, as cited in Cox et al., 2005). “Areas of confined feeding operations for cattle, hogs, and chickens are becoming a major source of water pollution. Only a small fraction of the Ogallala groundwater is

known to be contaminated such that it fails to meet drinking water standards” (Guru & Horne, 2000, as cited in Cox et al., 2005, p. 25).

The following subsection presents the history of the Water Quality Association in the U.S. to provide a bigger picture of the background and need for understanding water quality issues and concerns nationally. These issues become local concerns for people in regions faced with declining water quality.

History of the Water Quality Association in the U.S.

The Water Quality Association (2004) was formed in 1960, when water quality issues came to the forefront. Environmental issues were also facing the same damage in amplitude of lakes, polluted streams, and abandoned rivers. Phosphorus detergents from household use resulted in a negative impact of water on water quality. The water quality improvement was targeted to meet these concerns, but government agencies first needed to regain their reputation and acceptance among government officials, water utility managers, and consumers. The National Water Quality Monitoring Council (NWQMC) started the decade with its defense of the industry against government and water utility officials in Milwaukee, Wisconsin, who determined that Lake Michigan’s water was hard. The council was successful in clarifying in detail that Lake Michigan’s water was hard, with a concentration between 8-10 grains per gallon, which was very hard by U.S. Geological Survey Standards.

According to the National Extension on Water Quality Issues program, their major focus and the objectives of the Cooperative Extension System’s National Water Quality program from 1992 to 1995 focused mainly on protecting and improving rural household drinking water. One of the strategies of the NWQMC focused on a 46 state Extension Service

(ES). The national targeted program reported that there was at least one geographic area in these states with noticeable current or potential degradation of water quality from private wells. These states conducted an extension education program to address the problem.

According to the NWQMC, 31 states reported on drinking water quality programs in the identified geographic areas as part of their participation in the national Targeted Water Quality Program. Ideal participation included annually reporting program activities and associated outcomes during the four-year period. The majority of states within each region participated in the drinking water component, except for the Western Region, where only five states were involved. The Four Extension Program of the 1890 land grant institutions reported outputs in their respective programs.

The system helps evaluate pollution sources as well as site vulnerability, and recommends actions to prevent pollution. Sealing abandoned wells was emphasized more in the North Central Region than in other regions. Well water testing among low income rural residents was reported by a higher percentage in the Southern Region than in other regions.

The following subsection provides a background to understand constraints regarding water quality and teaching about water quality. Several theories are presented regarding the teaching and learning of agricultural education of professionals as well as laypersons. Adult motivation to learn is also addressed as a key factor to change behavior.

Constraints to Learning about Water Quality

According Gehlhar et al. (1997, p. 1), agricultural production often produces pollutants that affect quality of water resources and impose costs on water users. In 1994, the Environmental Protection Agency reported that agriculture is the leading source of

impairment in the Nation's rivers and lakes, and a major source of impairment to estuaries. Agriculture is also an important source of contaminants in some aquifers. The important agricultural pollutants that have been found in water resources include sediment, nutrients, pesticides, salts (from irrigation), and pathogens (from animal waste).

According to the Environmental Protection Agency (EPA), in 1990, the USDA made a commitment to protect the nation's waters from contamination by agricultural chemicals and waste products by establishing a Water Quality Program (WQP). This program builds upon past programs such as the Model Implementation Program of the 1970s, and the Rural Clean Water Program and Water Quality Special Projects of the 1980s. The Water Quality Program uses education, technical assistance and research to promote the adoption of alternative management practices for protecting water resources. According to the EPA (1990), the main goals of the WQP were to:

... (a) determine the precise nature of the relationship between agricultural activities and water quality; and (b) develop and induce the voluntary adoption of technically and economically effective agrichemical management and agricultural production strategies that protect the beneficial uses of ground and surface water quality. The lack of considering educational activities in addressing water quality issues was one of the main obstacles hindering learning interests and success regarding water quality issues. This can be seen as barriers for extension professionals and a constraint regarding motivation of learning and teaching about water quality issues. (1990, p. 27)

Conceptual framework of the teaching and learning process as it relates to agricultural education

According to Verduin et al. (1977, p. 3), the education of adults is a multifaceted, complex process which faces many subject and interest areas. It is as broad and varied as those it serves. It encompasses adult basic education (teaching basic learning and survival

skills to the undereducated), continuing education efforts for personal and professional growth, and enrichment activities for the highly educated.

Blum (1996) stated the need for effective teaching in agriculture is its interdisciplinary nature in order to be understood. Thus, to make teaching beneficial, it is necessary to adopt appropriate teaching concepts in agricultural education. What teaching-learning concepts are appropriate for educating people about water quality issues?

Adults have many perceptions of their environment and the objects and the events in it. “The sum total of all of these perceptions forms the past experiences of the individual. Adults’ past experiences form their behavior as they begin the class and are the starting points from which the behavior change (learning) process must proceed” (Verduin et al., 1977, p. 11).

According to Belanger and Valdivielso (1997), there is a

...need to assess the real magnitude and nature of the ‘silence explosion’ of adult education and training which has evidently occurred in the regions of the world. Adult and continuing education is a rapidly expanding domain, but difficult one to map. The most important feature of adult learning, hence a major difficulty for the analysts, is its diversity: the multiplicity of the educational agents involved, the variety of institutional and financial arrangements, the breadth of learning needs, and the different ways in which people participate in educational activities throughout the post-initial education lifespan. (p. 10)

Kolb (1984) gave more credit to the social context of adult learning by supporting that “learning occurs in a variety of modes; formal, informal, non-formal directed, self-directed, open, distance, etc.” (p. 1). Blum (1996) confirmed the effectiveness of teaching in the domain of agriculture in order to understand its interdisciplinary nature. Thus, to make teaching suitable, it will be necessary to apply appropriate teaching-learning concepts that are appropriate in educating citizens about water quality issues.

Experiential learning model

Learning involves change. It is concerned with the acquisition of habits, knowledge, and attitudes. It enables the individual to make both personal and social adjustments. Since concept of change is inherent in the concept of learning, any change in behavior implies that learning is taking place or has taken place. Learning that occurs during the process of change can be referred to as the learning process. (Crow & Crow, 1963, p. 1)

According to Burton (1963), “learning is a change in the individual, due to the interaction of that individual and his environment, which fills a need and makes learners more capable of dealing adequately with his environment” (p. 7). Jarvis (1987) suggested that, “no social situation has meaning in itself or for itself. Indeed there is a genuine sense that the experiences that factors have in a situation are socially constructed and the meaning imposed upon them, and this is important when seeking to understand adults learning” (p. 70). Coombs and Ahmed (1974) viewed non-formal education as “any organized, systematic, education activities carried on outside the framework of sub-groups of the population, adults as well as children” (p. 8). They also posited, “people learn within three different types of social environment: informal, non-formal and formal, and this distinction has given rise to some discussion in educational circles about different forms of social environment in which learning occurs” (p. 8).

According to the Verduin et al. (1977, p. 9), human behavior is a very complicated phenomenon, associated with many components. When profoundly viewed, each person possesses different characteristics, experience, values, needs, goals, persuasions, and ideas which cause each individual to behave differently.

For adult education to be successful, according to Brown, Lewis, and Harclerod (1977, as cited in Harclerod, 1977), “the goals to be achieved, the content to be taught, the

characteristics of the chosen methods, and learning capabilities of the adult students should determine the teaching technique” (p. 27). Verduin (1984) clarified that adult education should reflect what adults want because it helps to focus directly on the important concerns of society and the needs of adults to function adequately in society.

Thus, how does one select good programs to use as models? One can select existing programs that meet the need or can help one reorganize or reshape programs to address the growing adult learner demand. There is no universal answer to these quandaries. Merriam and Caffarella (1999, p. 264) posited that adult learning is characteristic of life situations, changes in learner consciousness.

Adult motivation to participate in learning is usually voluntary, although job loss and other exigencies may be compelling inducement. Adults’ decisions to enter education may involve competing tensions between incentives and disincentives, such as the need to improve income versus previous negative experience with school or peer attitudes. (Gross, 1981, as cited by Merriam & Caffarella, 1999, p. 57)

Knowles (1980, pp. 45-46) argued that adults develop a self-concept of being self-directing learners and an intense need to be perceived as such by others. According to Warner, Weil, and McGill (1989), “...experiential learning refers to a spectrum of meanings, practices and ideologies which emerge out of the work and commitments of policy makers, educators, trainers, change agents, and ordinary people all over the world” (p. 3).

Warner et al. (1989) also stated that, “experiential learning can be seen with different meanings, as relevant to the challenges they currently face, in their personal lives, in education, in institutions, in commerce and industry, in community and in society as a whole” (p. 3). Confirming the value of life experience and the learning within it by

emphasizing the value of learning may be underrated in our educational establishments (Lumber & Gardiner, 1987).

It is not important where, why or how learning is achieved but, rather, to identify what has been learned and can be assessed (CNAA, 1988). The inner world of the individual appears to have more significant influence upon his behavior than does the external environmental stimulus (Rogers, 1983).

Kolb's (1984) description of the learning cycle is comprised of four stages of experiential learning: concrete experience, observation and reflection, abstract conceptualization and generalization, and active experimentation. According to Warner et al. (1989, p. 29), eight different types of experiential learning are: independent learning, personal development, social change, non-traditional learning, prior learning, world experience, learning by doing, and problem-based learning. According to Warner et al. (1989), "the significance about experiential learning is not that it uses experience as a vehicle for learning, because of the approaches that can lay claim to the validity of this, but that the emergence of the concept of experiential learning represents an ideological shift" (p. 75).

Adults

Motivation for learning

Motivation can be viewed from many different perspectives, and has been researched long and exhaustively in social sciences literature (Higgins & Kruglanski, 2000; Pittman, 1998). As indicated in the following examples, the results have provided an integration of different concepts (Barbutto, 2001).

Leonard, Beauvais, and Scholl (1999) proposed an integrative model of motivation based on findings in the field. In their model, different theories were accumulated in identifying five sources of motivation: intrinsic process, instrumental, external and internal self-concept, and goal internalization.

Dollisso and Martin (1999) suggested promoting, designing, implementing and evaluating education and development activities. Agricultural educators have a uniqueness in the motivation of their target audiences (Swanson, 1984). More recently, studies have examined the motives or factors of individuals in rural community settings (Bajema et al., 2002; Culp, 1997). According to Trout (2004) motivation is a psychometric tool that can be used in the agricultural education field that can be used to accurately assess motivations of agricultural audiences.

According to Barker (1997), learning can be defined as, “a more or less permanent change in behavior resulting from personal experiences with an environment” (p. 3). Barker defined behavior as, “what you do, the ways you act, how you respond to your environment, much of your behavior is learned, but behavior change by itself is not learning” (p. 3).

Behavior theory encompasses the interplay of genes and environment (Halliday & Slater, 1983; Plomin, 1990). Learning from experience is important in each part of people’s lives. It is basic to solving problems, and for maintaining and enriching relationships. According to Cell (1982), people have the strength to make a difference, a difference that is significant in each of life’s situations. Cell also posited that, “experiential learning is a change in the learner, a change in behavior, in interpretation, in autonomy, or in creativity, or a combination of these changes” (p. 28). Learning is a complicated process in which one employs a large variety of skills, some of which are far better developed and more frequently

used than others. Cell continued that, “learning to learn from experience” examines the learning process in various types of social relationships. It shows how learning in large groups differs from that in intimate circles” (p. 28).

Educational outcomes of distance education are similar to those of traditional higher education (Biner et al., 1994; Zirkin & Sumler, 1995). Distance education for adults has gained tremendous recognition and respect from many other institutions. Many prestigious institutions are offering degree programs through distance education for adults who do not have access to a classroom set up.

According to Chickering and Gamson (1991), no matter which strategy one may use to promote learning in distance education courses, learning theories and principles that have been found successful in the traditional classroom remain constant regardless of the delivery mechanism. “Time plus energy equals learning. Learning to use one’s time well is critical for students and professionals alike. Allocating realistic amounts of time means effective learning for students and effective teaching for faculty” (pp. 19-20).

Mahrotra (2001) posited that learning is an active process, a realistic number of instructors applied technology to help students move from a passive stage to an active mode of learning. Mahrotra’s research focused on the impact of distance education and how it is increasing at a dramatic pace. The findings indicated the expansion is driven by several factors, including: the development of new computer and internet technologies, the increasing performance to price ratio of available computer technology, the societal need for more educated and technically sophisticated employees, the decreasing percentage of traditional aged college students seeking higher education, the emergence of for-profit

educational enterprises. For these reasons, distance education has played an important role in helping people to have access world-wide to the tools for learning.

Perception and human behavior

“Perception in a broad sense is the contractual processes and their constituents through which information from outside reality is picked up and becomes basic determinant of both inner, mental processing and action” (Greissler et al., 1983, p. 18). Gibson and Spelke (1966) noted a “perception of ongoing events” (p. 2). They emphasized, “the relevance of the perceivers over knowledge in guiding the perceptual exploration of events that result in the acquisition of new knowledge” (p. 24).

According to Gibson and Spelke (1966), there is a continuous focus on understanding the nature of what is perceived and appropriate ways to focus on three different levels:

- The idea that attention is the selective aspect of perceptions;
- The assumptions that what is perceived are patterns, objects, and events rather than stimulus; and
- The belief that differentiation is a central concept for understanding perceptual learning and perceptual development.

Some researchers such as Rock (1983) were curious to understand what distinguishes perception from other modes of cognition (such as imagination or dreaming or thought). Rock concluded that perception is the “mental representation of external objects and events that is based upon or in some way corresponds to the stimulation reaching our sense organs” (p. 28).

However, others believe the possibility that perception does not have to be learned. Perception is available from the beginning of one's life.

Knowledge can influence perceptions in cases where a perceptual solution is possible. Knowing about a solution could possibly assume that knowledge that is acquired will generally lead to that solution for the problem. Knowledge in the form of past experience, particularly memories of prior perceptions, governs recognition and certain cases where recognition affects perceptions.

Burge (1986) argued that typical computational theories of perception, such as Marr's theory of vision, actually presuppose and externalize the person and the mental stage of that person as well. It is not intended to demonstrate that all perception is based only on hands-on experience, and the innate capacity for perceiving is non-existent, or at least unimportant as is sometimes suggested by, for example, the transaction school of psychologists (Solley & Murphy, 1960). The form and movement of perception are closely linked and supported by processes of identification, classification coding with the operation of perceptual form which depends to a considerable extent on learning, memory, attention, reasoning, and language (Vernon, 1970, p. 1).

Personality development

For a long period of time, the focus of psychology regarded the topic of personality development in adulthood with low interest, even neglect. Many years ago the assumption held by most researchers in the field of education, as well as by society in general, was that when adults passed through the stage of adolescence, completed their formal schooling, began to work, established a family and settled down, then nothing exciting occurred for the

rest of their lives. According to Wrightsman (1988), "...many middle-aged people claim extensive personality and behavior changes that in some ways resemble a second adolescence. Adulthood is especially the nature of personality development during an extended period has become a topic worthy of scholarly study" (p. 11).

According to Wrightsman (1994), "the phenomenon of the "mid-life crisis" exploded into consciousness in the middle of the 1970s, when the social researchers reactivated a long dormant interest in adulthood" (p. 11). Researcher were beginning to realize that adults do learn and, perhaps, change can be accomplished through the education of adults.

Systems approach to education

When designing this type of process in the systems approach, it is advised to view the relationships among sub-systems or components. According to Jayarantne (2001), "the systems approach is useful to comprehend a broad view of problems within a productive framework for understanding the process and functions inherent within the systems" (p. 25).

What is the meaning of a systems approach in agricultural education? Blum (1996) defined agriculture as "a complex subject which cuts across many scientific, social and practical disciplines" (p. 16). Thus, the systems approach provides a useful method in the domain of agricultural education for encouraging and facilitating learners to understand the holistic view of farming systems

Vernon (1970) concluded that the exact perception has strong spatial relations can be acquired only through learning the belief that their main effects are indirect functioning through the varied acquisition by different individuals of particular knowledge and skills. According to Marisol (2000), "learning from change is about the different lenses through

which diverse groups and people are able to view, describe and act on change” (p. 1).

Marisol also clarified that changing the way one learns about the results impacts one’s developmental effort.

Teaching adults

When teaching and working with adults, it is highly recommended to place emphasis on adults and the manner in which they best learn. Why and what do adults learn? How much time do they spend at learning? Is their learning self-planned, or do they go to classes and groups? Can teachers provide better help for individuals to learn? Thus, it is important to focus on adult learning needs and creating an environment for optimal learning.

During the past decade, these questions have been the main preoccupation of education systems in the U.S. (i.e., schools, communities, universities, etc.). From this societal interest, the birth of adult learning emerged. According to Tough (1971, p. 9), adults’ intention to gain certain knowledge and skills includes any positive or desired changes or improvement in a person’s knowledge, understanding, awareness, comprehension, beliefs, ability to apply, ability to analyze and synthesize, ability to evaluate, judgment, perceptual skills, physical skills, competence or performance response tendencies, habits, attitudes, emotional reaction, sensitivity, confidence, patience and self-control.

“Adult basic education teaches basic learning and survival skills to the under educated, continuing education efforts for personal and professional growth, and enrichment activities for the highly educated” (Verduin et al., 1977, p.1). According to Verduin and others, “human behavior is a very broad and complex phenomenon, involving numerous components. It is also a very individualized phenomenon; each person possesses a different

package of experience, values, needs, goals, persuasions, and ideas which cause one individual to behave differently” (p. 9).

According to Macleroad (1977), for adult education to be successful, “the goals to be achieved, the content to be taught, the characteristics of the chosen methods, and the learning capabilities of the adult students should determine the teaching technique” (p. 24).

Adult learning

Verduin (1997) stated that, “competency based material can be very pragmatic for adults because it can focus directly on the important concerns of society and the needs of adults to function adequately in society” (p. 174). Verduin also added that specifying performance based on evaluation tests are necessary but not sufficient to determine if learning has been achieved (p. 173), but later concluded that an adult’s performance being compared with a prior established selection of the standards to be employed in judging an adult’s learning is a vital factor in the evaluation process.

According to the National Center for Education Statistics (1997, 1998, as cited in Fauve et al., 1972):

...every person must be in position to keep learning throughout his life. Education must be carried on at all ages. According to each individual’s need and convenience, lifelong learning is proposed as the master concept for educational policies in the years to come. The lifelong concept covers all aspects of education—with the whole being more than the sum of its parts. Lifelong education is not an educational system, but the principle on which the overall organization of the systems is founded. (pp. 180-182).

Delors and Associates (1997) viewed the concept to take in consideration greater understanding of other people and the world surrounding them which will include four levels

of learning: learning to live together, learning to know, and learning to do. Fauve et al. (1972) suggested the last one as learning to be.

The European lifelong learning initiative's first global conference on lifelong learning which convened in Rome in 1994, enunciated the following active definition of lifelong learning: "A continuously supportive process which stimulates and empowers individuals to acquire all the knowledge, values, skills, and understanding, they will require throughout their lifetimes and to apply them with confidence, creativity and enjoyment in all roles, circumstances and environment" (Longworth & Davies, 1996, p. 22).

Similarly, the 1998 UNESCO World Conference on Higher Education in the 21st century charged higher education to embrace all forms of learning and to become an active provider of lifelong learning opportunities. Lifelong learning and adult learning concerns permeate the entire conference report (UNESCO, 1998).

Adult education, since its origin, has emphasized that human and democratic potential can be achieved through increased education (Lindeman, 1988, as cited in Stubblefield, 1988). Many people outside the profession of adult education have considered adult learners as playing catch-up after a failure to accomplish expected stages of education at the suitable age. Adult education has been considered a remedial effort to repair an earlier omission (Keeton, 1997). In the economist point of view, "the new jobs in tomorrow's industries, manufacturing and services alike—will require workers that are literate, numerate, adaptable, and trainable in a word, educated" (Education and Wealth of Nations, 1997, p. 15). President Clinton's 1997 State of the Union message included "in the twenty-first century we must expand the frontiers of learning across a lifetime. All our people, of whatever age, must have a chance to learn new skills."

A major influential factor in adult education theory is strongly linked through lifelong learning. Adults can achieve understanding of the complex world they live in and can influence the world through their democratic participation (Stubblefield, 1988; Stubblefield & Keane, 1994). A report from the National Association of College and University Business Officers (NACUBO) indicated concern about the rapidly shifting demography of higher education enrollments, arguing that these trends were “causing a paradigm shift in higher education.” Through volunteer programs, many of which already exist, or employment, they can contribute to meeting the learning needs of persons younger and less experienced than themselves (Hubler, 1999; Perkins, 1997; Prisuta, 1997; Scheibel, 1997).

A projection workforce 2020 analysis described that the large number of low-skilled, low-wage jobs will continue but also points out that greater opportunity lies in jobs that require higher skills gained through education (Judy & D’Amico, 1997, pp. 69-83). Many companies in the United States have recently created the Talent Alliance, a program that assists their employees to plan their career development and to select education and training to support it and that facilitates movement toward new jobs within the participating industries (Lancaster, 1997).

Grubb (1996) considered a realistic look at educational needs of the largest segment of workers who are those who have completed high school without a baccalaureate degree. According to Maehl (1999), “information technology has transformed the nature of work and the structure of employment. It has already enormously increased the ways in which people can learn, and it promises to do much more in the future” (p. 24). Workforce 2020 estimates that 60% of the U.S. households will have computers by 2000, and that the number will increase to 90% by 2010 (Judy & D’Amico, 1997, p. 19).

“Business, more than government, is instituting the changes in education that are required for the emerging, knowledge-based economy—over the next few decades, the private sector will eclipse the public sector as our predominant educational institution” (p. 170; see also Davis & Botkin, 1994). Many have looked at adult learning as the way to catch up or making up for earlier deficiencies. The most valuable new change is that an adult’s search for learning is no longer viewed as catching-up. Today, with the continuous way life changes and the economic and social status of adult learners, learning has become a permanent condition of improvement. Most important in making this happen has been the great variety of learning opportunities, accessibility, and its expansion. Learning can occur in a more flowing environment than the traditional higher education delivery.

Problem-solving approach.

According to Hill (1979) “problem solving is another way of learning” (p. 15). Some researchers believe in the importance of the location of the problem. Maier (1963) described that it is necessary to appreciate the way and location of the specific problem or obstacle influencing the thinking process, and also to pay attention to how to analyze the situation in detail. Blum (1996) viewed the problem-solving approach as a strong link to teaching and learning which is strongly connected to the theories of John Dewey.

The problem-solving approach has a strong relationship with critical and creative thinking, and also gives power to the learner to develop a vision for prosperity in the future (Torrance, 2000). In the field of teaching agriculture, the use of problem solving is not widely used, whereas in other disciplines such as science, mathematics, aerospace science, engineering, etc., its application is common. Schmuck et al. (1966) used the problem-solving

approach to distinguish five different phases in adopting the problem-solving and teaching approach. The first phase is the identification of the problem and difficulties for accomplishing learning objectives. The second phase looks at the diagnosis of the problem, on the specific level the educator needs to re-examine the problem setting to enable her/him to pay attention to specific information and choose suitable diagnostic tools and techniques that will give the educator knowledge of specifics. The third phase is developing a plan to present the problem and get the learners involved. In the fourth stage, the educator uses the selected problem and interacts with the learners. The last stage is evaluation. In this final phase, the educator gets feedback from learners and redesigns the next learning cycle. The above statements on problem solving have strong connection with the actual model for this study.

Brown (1998) found that the most difficult issue when facing the problem-solving approach in teaching is people's reluctance to shift from traditional teaching methods. Another aspect that can strongly influence is the effectiveness of the problem-solving approach. The person in charge of delivering the message needs to constantly improve his or her skills in group dynamics and communication.

Brown (1998) strongly advised that, in the problem-solving approach in education, the person in charge of delivering the message must follow three steps: balance of power in the classroom, focus of attention and teaching skills. The success of problem solving in agricultural education situations is beneficial for the learners to apply subject matter knowledge in real life situations.

The teachers' role in this real situation is more as facilitator than leaders (Brown, 1998). Stepien and Gallagher (1993) found that the problem-solving approach involved

engagement, inquiry, solution building and reflection. Where engagement stands for “the problem raises concepts and principles relevant to the content area and addresses real issues to the larger social context of the students’ personal world” (Brown, 1998, p. 4).

Perception and social context

Hentschel et al. (1986) envisioned that the social context of perception does not necessarily mean conceptualization of continued activity. In several research studies it is mentioned that social context plays an important role in the interpretation of individual differences in object perceptions (Smith & Westerlundh, 1980). The experience from these researchers regarding perception can be applied with extension agents’ perception toward water quality education may differ in different social contexts.

According to Wilding (1983, p. 22), the approaches to explaining perception follow different steps by which it is easy to explain the phenomenon of perception. Among the five steps, only three are related to the current study:

1. The specification of precise accomplishment of information acquired in a specific situation where everyone acquires similar knowledge or whether individual differences exist, and, if so, what type.
2. The nature of the effective input or stimulus, or how it can most usefully be described, must be isolated.
3. The specification of processes in the observer motives, expectation, etc. The effects of culture, language, social pressure need to be included in the complete description of what happens.

Perception and knowledge acquisition.

Holzkamp (1973), as cited by Hentschel, Smith, and Draguns (1986), clarified that perception deals less with the central role in the conceptualizations that focus on action and the aspect of scientific knowledge. Royce (1974) revealed three fundamental links to knowledge: logical-illogical thinking link, universal-idiosyncratic symbolizing link, and perception-misperception sensing link. Holzkamp (1973) also looked at perception as the non important link to knowledge. However, Royce (1974) cautioned against viewing these three links as independent. Based on this view it can be predicted that someone's perception toward water quality education may be different from that of his/her knowledge. This strongly suggests that a knowledgeable extension agent may have a negative perception toward water quality education in agriculture.

According to Prinz (1993), perceptions strongly adapt and involve recognition of information. During the process of recognizing information, people involve an external stimulus stored in the individual memory. Surprisingly, the process of perception does not rely merely on an external stimulus, which indicates that the level of prior education influences the effect of perception. From this, it can be inferred that there might be a relationship between agricultural extension educators' perceptions and their demographic characteristics such as level of education, experience, and the aspect of training on water quality issues related to agriculture.

Review of Related Studies in Water Quality Education

The role of Cooperative Agricultural Extension educators in water quality education is to provide and support education programs to improve surface water quality. Their

assistance and support are directed at two primary audiences: agricultural extension educators and natural resources agency personnel. This approach of “training the trainer,” that is, providing education to educators and technology transfer specialists who can then impact more farmers than one single person, has enabled these groups to direct their efforts toward the promotion of best management practices for reducing chemical runoff in the basin (Boohar et al., 1996).

Working as a team by doing demonstrations, hands on practice contributed to the success of Education efforts on the Blue River Basins Project started in 1995. Farmer surveys from 1996 to 1998 indicated results similar to Zoubek’s (1997). These results indicate that, since 1992, education efforts by practicing demonstration, field day and workshops have helped atrazine use rates decline and band application rates increase within the upper basin (Blue River Basins Survey, 1996).

By 1999, the educational program had shown positive results. Ninety-five percent of the farmers in the targeted watersheds had adopted Kansas State University’s recommended best management practices for atrazine. In addition, surface water monitoring indicated that reductions in atrazine concentrations in surface water in the targeted watersheds had occurred (Boohar et al., 1996).

Both Extension education and research efforts have contributed to increasing the adoption rate of best management practices throughout the basin of Kansas. This has been from the efforts of many groups and individuals providing education and incentive to make changes. Coordination between two states in university research, state agency efforts, and program focus of private organizations has contributed toward the solution of this two-state problem. Results show that adoption of atrazine best management practices is occurring in

the basin. Continued education efforts will increase adoption and reduce the atrazine runoff that may impact downstream drinking water (Frankforter, 1994).

These results provide a clear indication of the necessity of suitable in-service training programs uniquely designed for learning about water quality education. The teaching learning process required the understanding the process related to water quality education is determining factor in designing effective training programs.

Need for a New Education to Improve Drinking Water Quality

According to D'Itri and Wolfson (1987), public concern has risen as increasing population and industrial growth have placed heavier demands on the existing water system, especially ground water. More than 95% of the nations comprise a rural population and more than 50% of the urban population depends on groundwater as drinking water.

Each year in the United States, farmers apply approximately 11.5 million tons of commercial nitrogen fertilizers and 1.1 billion tons of pesticides are used each year, and between 3.5 and 21 million pounds (0.5 to 3%) are estimated to leak to the ground or surface water resources (Vanclay & Bronstein, 1995).

The process of developing drinking water standard in the U.S. is complex. This complexity is first of all due to the need to integrate scientific knowledge with legal requirements and actual societal values. The risk assessment method start by revising all alternatives of adverse effects of a particular contaminant and determining which effects are significant through drinking water. (Clark & Clark, 1995, p. 43)

According to Reeves and Ellsworth (1984), "the United States has enjoyed an abundance of clean water available at a low cost. However, according to some writers and specialists, the nation's water future is very much in doubt and, indeed, may soon develop into a crises" (p. vii).

Perception is an important determinant of human behavior (Pittenger & Gooding, 1971). Years of experience constitute a determining factor that characterizes the content of the human point of view (Allport, 1955). By looking at the work of several researchers regarding focus on agricultural extension educators' perceptions regarding water quality education, this study takes a close look and retests experiential learning theory to establish a relationship between adult learners' perceptions regarding a new concept such as water quality education in agriculture and adult learners' motivation for learning how to approach of the raising issues.

Summary

In the review of literature, the Organization for Economic Cooperation and Development (OECD, 1999) revealed that, "learning is an integral part of wider measures to help overcome exclusion and to build the pathways to conclusion" (p. 20). Not only do difficulties present opportunities to look for possible solutions to problems associated with exclusion, but they also constitute important considerations. Based on the previous statement, the OECD addressed the issues of "knowledge economies" and a learning society" in which the important aspects of knowledge, skills and learning participation reflect modern life that has become more and more obvious with current shifts in the economy wherein it is difficult to avoid the effect of labor market changes.

In the new era of learning and the rapid change of technologies, adult skills tend to be inadequate and struggle to keep pace with new technologies (OECD, 1999). The social gathering context of adult education is a good environment which enables people to meet semi-socially as there are numerous people who attend their local adult education center for

social reasons (Nicholas, 2002, p. 17). Nicholas also remarked that the benefit of learning in a group is based on socializing; otherwise, one would not find huge number of adults reengaging themselves to attend yearly education and training (p. 29). Adults vary considerably in terms of knowledge, ability, learning style, and motivation. Thus, teaching each type of learner on an individual basis is hard enough, whereas what occurs when learners are grouped can be simplified. “The feature of performance aligns itself with current educational research that examines the multiplicity of roles, both within and without instructional contexts, that teachers assure in the course of their professional lives” (Alexander et al., 2005. p. 29). “No country can extend its development beyond the stage reached by its education” (Stock, 1979).

From a review of past studies, “the sum total of all of these perceptions forms the past experiences of the individual. Adults’ past experiences form their behavior as they begin the class and are the starting points from which the behavior change (learning) process must proceed” (Verduin et al., 1977, p. 11). Hentschel et al. (1986) envisioned that the social context of perception does not necessarily mean conceptualization of continued activity.

The approach of “training the trainer,” that is, providing education to educators and technology transfer specialists who can then impact more farmers than one single person, has enabled these groups to direct their efforts toward the promotion of best management practices for reducing chemical runoff in the basin (Boohar et al., 1996). By investigating agricultural extension educators’ perceptions regarding water quality issues in the North Central Region of the United States, this study could provide an opportunity to reframe experimental learning theory and link the relationships between adult learners’ perceptions

regarding the issues of water quality issues and their level of motivation for learning about water quality.

Based on the literature review, several research questions were developed to guide the study. The questions specifically address agricultural education of water quality professionals and their perceptions about water quality.

Research Questions

The following research questions framed and guided the study:

1. What perceptions do agricultural extension educators have related to water quality issues in agriculture?
2. What perceptions do agricultural extension educators have regarding the principles related to the teaching-learning process focused on water quality issue with agriculture practice issues?
3. What factors limit agricultural extension educators learning about water quality practices?
4. What teaching methods and tools can be used effectively to educate agricultural extension educators regarding water quality agricultural technologies?
5. What factors motivate agricultural extension educators in extension work?
6. Is there a relationship between agricultural extension educators' perceptions about water quality issues related to agriculture and their level of motivation for learning more about water quality?

CHAPTER 3. METHODS AND PROCEDURES

The purpose of this study was to determine agricultural extension educators' perceptions regarding the teaching-learning process pertaining to the use of water quality practices, and identify the relationship between agricultural extension educators' perceptions and their motivation for learning about water quality related to agriculture. The study took into consideration the implications for designing an in-service training model for agricultural extension educators focused on water quality on agriculture practices.

The objectives of the study were to:

1. Identify agricultural extension agents' perceptions about water quality issues.
2. Identify agricultural extension agents' perceptions regarding the principles related to teaching-learning processes focused on water quality issues.
3. Identify effective teaching tools and methods for providing education regarding agriculture practices related to water quality issues.
4. Identify the factors that limit agricultural extension educators learning about water quality practices.
5. Determine the factors that influence agricultural extension agents' motivation for extension work.
6. Determine the relationship between the agricultural extension educators' perceptions about water quality issues and their level of motivation for learning more about water quality.
7. Develop an in-service training model for agricultural extension educators focused on water quality issues.

Research Design

Sample survey research design was applied in this study. This was deemed an appropriate design for the study since the objectives of this study were exploratory,

descriptive, and correlational. The required data were obtained by using a self-administered structured email questionnaire that is similar to a mailed survey because the method is both time and cost effective (Tuckman, 1978).

Population and Sampling Procedure

The population of this study was comprised of 300 agricultural extension educators in the 12 states of the North Central Region of the United States. Of the original total, 213 agricultural extensions responded to the survey, for a 71% response rate. The validity and reliability study of the instrument were assessed by conducting a pilot study that focused mainly on extension professional educators. The Cronbach reliability coefficient for the specific parts of the instrument ranged from .80 to .96, ensuring the instrument was adequate and reliable for the study.

A proportional stratified random sampling method was utilized to draw the study sample. Ary, Jacobs, and Razavich (1996) stated that stratified random sampling can provide a more accurate representative sample according to the manner in which agricultural extension educators are assigned in different states (rather than using simple random sampling in such cases).

There were 300 agricultural extension educators in the target population. Krejcie and Morghan (1970) advised that the appropriate sample size for a similar population should be approximately 270 agricultural extension educators. During the pilot-testing the instrument of a randomly selected sample of 24 agricultural extension educators, approximately 92% (91.66%) of the agricultural extension educators responded to the questionnaire.

This sample was randomly drawn proportional to the total number of agricultural extension agents in each of the twelve states. The sampling frame was proposed by using information received from the Associate Dean of Extension and Outreach on Soil and Water at Iowa State University, the Natural Resources and Environment Extension State Directors web sites, and the 2004-2005 County Agents Directory. The returned rate for this study was 71%.

Survey Questionnaire and Instrumentation

The idea of survey questionnaires rises from several meetings that we organized with the water resources committee in the Department of Agricultural and Biosystems Engineering comprised of Profs. Jim Baker, Ramesh Kanwar, Jeff Lorimor, Stewart Melvin and Gerald Miller. This researcher met several times with these committee members in order to address appropriately the alarming water quality situation facing the North Central Region of the U.S.A and consider the impact of the educational aspect of the research. The questions in the survey were built on collaborative work between the Department of Agriculture and Biosystems Engineering, and the Department of Agricultural Education and Studies and Iowa State University Extension.

A survey questionnaire was designed to collect data for this study. This questionnaire was developed based on the literature review, the researcher's personal team experience, and contributions from Iowa State University's water resources team. The questionnaire includes the following sections.

The survey questionnaire contained the following sections:

- Agricultural extension educators' perceptions regarding water quality issues

- Agricultural extension educators' perceptions about the teaching-learning process
- Agricultural extension educators' limitations to learning about water quality practices
- Agricultural extension educators' teaching methods and tools
- Agricultural extension educators' motivation
- Demographic information
- Develop an in-service training model for agricultural extension educators focused on water quality issues.

For parts 1 and 2, a five-point Likert-type scale was used in which the scale ranged from 1=strongly disagree to 5=strongly agree. For part 3, a five-point Likert-type scale was also used, in which the scale ranged from 1=not at all to 5=very much. In part 4, a five-point Likert-type scale was used as well, which ranged from 1=not very effective to 5=very effective. In part 5, a similar scale was also used, ranging from 1=very low to 5=very high. The perception-measuring instrument consisted of 10 statements.

Validity and Reliability

Ary et al. (1996) defined validity as the meaningfulness, appropriateness and usefulness of the inferences made from the scores of the instruments. Reliability refers to the ability of the survey instrument to obtain consistent data from respondents. The reliability of the survey instrument was verified by establishment of the Cronbach's reliability coefficient from the pilot-test data. The Cronbach's reliability coefficient for the instrument ranged from .80 to .96 for the respective sections of the instrument, indicating that the instrument was adequately reliable for the study.

It can embrace three main areas of validity to be utilized during conducting a program in research: face validity, content validity, and external validity. Face validity of the

survey instrument was to take into consideration the feedback received from agricultural extension educators during pilot-testing.

Content validity, which focuses on the meaningfulness of the instrument, is used to provide a close approximation of the intended human behavior. This ensures the constructs or scale variables are measured accurately and completely from multiple perspectives. The construct validity of the instrument was established through references to the research literature on perceptions of farmers/public philosophies/beliefs. The validity of the instrument determines the extent to which the desired underlying constructs or variables are being measured (Ary, Jacobs, & Razaviech, 2002). The evidence of a relatively high construct validity achievement by the instrument is represented by the relatively high reliability of estimates expressed by the Cronbach's alpha coefficients reported for the instrument (Ary, Jacobs & Razavieh). Convergent validity can be defined as the confirmation of the existence of a trait or behavior by independent measurement, whereas discriminant validity may be defined as the extent to which a given trait is differentiated from other traits (Thomson, 1970). Convergent validity and discriminant validity can be completed by using a multiplicity of traits or factors rather using a few factors in rating scales (Lawler III, 1967). Convergent validity addresses confirmation of the time of the trait or behavior by independent measurement, whereas isolation validity is the extent to which a given factor is differentiated from other factors (Thomson, 1970). Lawler (1967) suggested that convergent validity and discriminant validity are achievable by applying a multiplicity of factors rather than taking into consideration a few elements in rating scales.

Data Collection

The Human Subject Committee at Iowa State University reviewed and approved the survey questionnaire used in this study (see Appendix A). The survey was then emailed to the extension leaders in the North Central Region of the United States to select 25 agricultural extension educators in their areas (see Appendix B for the survey). After receiving the names from the program leaders, a pre-notice email was sent out to all respondents and they were asked to complete the survey online within a week. The pre-notice explained the purpose and objectives of the study, as well as an encouragement to participate. Each of the state agricultural extension educators with a focus on water quality education or similar area of interest was informed of the study by an email message with a copy of the survey questionnaire. A week after the first email was sent, a reminder email was sent to non-respondents requesting their response. Since the response rate was not adequate, a second email was sent. Non-response error was addressed as indicated by Miller and Smith (1983), it is acceptable to assume that there are no differences between respondents and non-respondents, by conducting a telephone interview with a randomly selected sample of non-respondents and these data were compared with data received from the email questionnaires.

Data Analysis

Questionnaire items were coded and entered into the statistical package for Social Sciences (SPSS Windows) computer program for data analysis on March 5, 2005. Two expectations of the analysis in the study were: (1) summarize the data; and (2) analyze the relationship between the extension agents' perceptions and other variables.

The following statistical analyses were conducted to satisfy these analytical expectations: (a) descriptive statistics such as means, standard deviations, and percentages of the variable of interest; and (b) correlation coefficients between the perceptions and the other variables.

Assumptions of the Study

The following assumptions were made regarding the study:

1. The respondents provided accurate information.
2. The respondents did not interact with each other in responding to the questionnaire.

Limitations of the Study

The findings of this study may have been limited by the following factors:

1. The sampling frame was made by using three sources: the agricultural extension educators' list provided by extension program leaders, websites, and the 2004/2005 County Extension Agents' Directory. The agricultural extension agents who may not have been listed in any of these sources were not in the sample. Some of the agricultural extension educators have blocked email from unknown sources (spam blocking message). This situation represents a violation of the random selection principles and can be a limiting factor for the external validity of the study.
2. This was a study based on perception, and it should be noted that human perception varies with time. Therefore, the findings of this study reflected only the situation at the time of data collection.

3. This study population was limited to the agricultural extension educators in the North Central Region of the U.S.A. Therefore, the findings of the study were limited to this study population.

CHAPTER 4. RESULTS AND FINDINGS

The purpose of this study was to determine extension professional educators' perceptions regarding the teaching-learning process focused on water issues, and the relationship between the agricultural extension educators' perceptions and their motivation for learning more about water quality issues. The study sought to draw implications for designing an in-service training model for agricultural extension educators focused on water quality issues related to agriculture. The findings of this study will be presented objective by objective.

Demographic Characteristics

As shown in Table 1, respondents' age ranged from 24 to 65 years, with mean of 47.07 years and standard deviation of 9.12 years. The number of years of experience in service ranged from 0 to 42, with mean of 16.50 years and standard deviation of 9.54 years. Respondents had 16.5 mean years of experience in extension service.

As shown in Table 2, the majority of respondents were over 46 years old. Most (86.3%) were male, whereas 13.7% were female. Most (80.4%) of the respondents

Table 1. Means and standard deviations of selected demographic characteristics of agricultural extension educators ($n = 213$)

Demographic item	Minimum	Maximum	Mean	SD
Age	24	65	47.07	9.12
Years of extension service	0	42	16.50	9.54

Table 2. Demographics of agricultural extension educators by educational level, gender, and major ($n = 213$)

Demographic item		Frequency	Percentage (%)	Cumulative %
Age	($n = 213$)			
	24 – 28 yrs	8.3	3.9	3.9
	30 – 35 yrs	19.6	9.2	13.1
	36 – 40 yrs	20.4	9.6	22.7
	41 – 45 yrs	35.8	16.8	39.5
	46 – 50 yrs	52.4	24.6	64.1
	51 – 55 yrs	36.0	16.9	81.0
	56 yrs and older	41.0	19.2	100.0
Gender	($n = 213$)			
	Male	182	86.3	
	Female	29	13.7	100.0
	Missing	2	0.9	
Degree status	($n = 213$)			
	BS	41	19.5	19.5
	MS	145	69.0	88.5
	PhD	24	11.4	100.0
	Missing	3	1.4	
Major	($n = 213$)			
	Agronomy	44	20.7	20.7
	Animal Science	63	29.6	50.3
	Horticulture	6	2.8	53.3
	Agriculture Education	43	20.2	73.3
	Other	65	30.5	103.8

had either a Master's or Doctoral degree, whereas nearly one-fifth (19.5%) had a Bachelor's degree. Of those with a B.S. degree, one-third had majored in Animal Science (29.6%). Slightly more than two-fifths (40.9%) had educational degrees in agronomy or agriculture education, whereas those indicated as Other (30.5%) were involved with different options. The final 2.8% had majored in horticulture.

Extension Agents' Perceptions Regarding Principles Related to the Teaching/Learning Process with a Focus on Water Quality Issues

As shown in Table 3, the results of the second objective indicated general perceptions about the teaching and learning process had a mean rating of 3.86 and standard deviation of .668. For perceptions on water quality issues, the mean was 3.82 with standard deviation of .608. Principles related to the teaching-learning process focused on three main areas: (a) educational program planning; (b) delivery, and (c) evaluation. Regarding program planning, the respondents agreed that training programs should be built on the target participants' needs and interests to drive a positive learning outcome. When program evaluation was taken into consideration, the respondents moderately agreed that the evaluation of extension training should be based on the accomplishment of the participants' learning objectives.

Table 3. Mean and standard deviation of perceptions about the teaching-learning process and perceptions of water quality

Perception	Mean	SD
Teaching-learning process	3.86	.668
Water quality	3.82	.608

Perception of Effective Teaching Methods and Tools for Providing Education Regarding Water Quality issues

Regarding the third objective, the survey instrument focused on extension professional educators' perceptions regarding effective teaching methods and tools useful in learning about water quality issues (see Table 4). Respondents perceived that the survey instrument included efficient teaching methods and tools for teaching water quality issues. Respondents were asked to indicate how effective each of these teaching methods and tools were for educating agricultural extension educators about water quality issues based on a five-point Likert-type range from 1 (not very effective) to 5 (very effective). In addition to

Table 4. Means and standard deviations of agricultural extension educators' perceptions regarding the level of effectiveness of selected teaching methods and tools for teaching and learning about water quality agricultural technologies ($n = 213$)

Teaching method	Mean	SD
Demonstrations	4.36	.930
One-on-one instruction	4.23	1.029
Seminars	3.24	.872
Group discussions	3.52	.969
Lectures	2.67	.914
Other	.31	1.071
Teaching tool		
Field days	4.05	.943
Study tours	3.87	.967
Workshops	3.69	.893
Printed materials	3.20	.864
Web sites	3.08	.988
Computer programs	2.92	.944
Video tapes	2.59	.970
Slides	2.54	1.011

Scale: 1= not very effective to 5= very effective.

these teaching methods and tools, respondents were asked to list any other teaching methods and tools they would consider effective in teaching issues related to water quality.

The highest mean value (4.36) for teaching methods was accorded to demonstrations, followed by one-on-one instruction (4.23), and seminars (3.23). Group discussion (3.52) was rated as a moderately effective teaching method. Lecture (2.67) was rated the least favorable choice among the respondents. Thus, agricultural extension educators perceived lectures as a less effective method to convey a message about issues regarding water quality.

Other methods (.31) most likely were not used by the respondents. Demonstration was the most popular teaching method, because hands-on practice, sharing information, communication among participants and team work are considered by agricultural educators to be the most effective way to teach and learn a skill.

The highest mean value (4.05) for teaching tools was for field days, which indicates that respondents were most in favor of field days as a very effective teaching tool for learning about water quality agricultural technologies. The second highest mean value (3.87) was reported for study tours. Workshops had mean value of (3.69), which indicates the respondents were favorable towards the use of workshops as an effective venue in which to teach and learn about water quality agricultural technologies. Printed materials ranked fourth, with mean value of 3.20, as effective resources in teaching and learning about water quality issues. Other moderately effective resources for teaching about water quality were website (3.08), computer programs (2.92), videotapes (2.59), and slides (2.54).

Factors that Limit Agricultural Extension Educators' Learning about Water Quality Practices

Findings from objective four indicate that availability of time was the most significant limiting factor for respondents to learn about water quality practices (Table 5). The highest mean was (3.88). There was only .5 difference in the means of the next four limiting factors, with a descending range from 2.80–2.75: Clarity about the use of new agricultural technology (2.80), training opportunity (2.77), opportunity to interact with researchers (2.75), and networking (2.75). Access to instructional materials (2.47) and access to instructional materials (2.47) had the lowest mean rating.

Table 5. Means and standard deviations of factors that limit agricultural extension educators' learning about water quality practices ($n = 213$)

Limiting factors	Mean	SD
Availability of time	3.88	1.151
Clarity about the use of new agricultural technology	2.80	1.104
Training opportunities	2.77	1.148
Opportunity to interact with researchers	2.75	1.213
Networking opportunities	2.75	1.135
Access to research information	2.59	1.212
Access to instructional materials	2.47	1.172

Scale: 1 = not at all to 5 = very much learning about water quality practices.

Factors that Influence Motivation of Agricultural Extension Agents

The factors that influence agricultural professionals' motivation were selected by using a nine-item instrument (objective five) (see Table 6). Agricultural extension educators were asked to indicate how influential each of these items were in motivating them for their

Table 6. Means and standard deviations of factors that influence agricultural extension educators' motivation ($n = 213$)

Factor	Mean	SD
My level of motivation for work	4.20	0.842
My positive attitudes toward the program	4.03	0.929
My professional commitment	3.96	0.951
Personal satisfaction	3.80	1.063
Level of motivation for learning about water quality	3.66	0.874
Available technical support	3.57	1.024
My technical competency	3.53	1.035
Appreciation of work	3.44	1.109
Extension council interest	3.31	1.173
Administrative support	3.23	1.058
Recognition of work	3.11	1.087

Scale: 1 = very low to 5 = very high; bolded indicates significance at $p = < 0.01$.

work based on a five-point Likert type range from (1) very low to (5) very high (Table 6). *My level of motivation* had the highest mean value (4.20) and standard deviation of .842, which was significant ($p = 0.01$). The next three factors followed closely as influencing motivation: *My positive attitude toward the program* ($M = 4.03$; $SD = 0.929$) and *My professional commitment* ($M = 3.96$; $SD = 0.951$), and *Personal satisfaction* ($M = 3.80$; $SD = 1.063$). Six factors were similar, with means ranging from 3.66–3.31: *Level of motivation for learning* ($M = 3.66$; $SD = 0.874$); *Available technical support* ($M = 3.57$; $SD = 1.024$); *My technical competency* ($M = 3.53$; $SD = 1.035$); *Appreciation of work* ($M = 3.44$; $SD = 1.109$); and *Extension council interest* ($M = 3.31$; $SD = 1.173$). Two areas that were the least influence on motivation were: *Administrative support* ($M = 3.23$; $SD = 1.058$) and *Recognition for work* ($M = 3.11$; $SD = 1.087$), possibly indicating agricultural extension educators are aware they

receive little administrative support, and therefore little recognition for their work, and these factors do not affect their motivation as agricultural extension educators. The top four means most likely indicate that intrinsic motivation is clearly important to agricultural extension educators, whereas the lowest means indicate agricultural extension educators are not as motivated by extrinsic factors.

Agricultural extension educators were asked to consider their self-perceptions regarding motivation for extension work and learning about water quality practices. A five-point Likert-type range from 1 = very low to 5 = very high was used to ascertain the level of motivation for extension work. Addressing the level of motivation for work, the mean and standard deviation were 3.66 and .874, respectively, which indicates that respondents agreed their level of motivation played a crucial role in learning about water quality issues.

All of the agricultural extension educators' perceptions were very high, which indicates they were very enthusiastic about extension work, particularly on water quality issues. The perceptions of the respondents regarding their motivation for learning more about water quality practices also were taken very seriously.

The motivation that the agricultural extension educators had for their work and about learning also were assessed. The mean for level of motivation (4.20) was slightly higher than the mean for motivation about learning (3.66), which indicates agricultural extension educators were slightly more motivated about their work regarding water quality issues than they were motivated about learning (Table 7).

Table 7. Means, standard deviations, and mean regarding other level motivation and level about learning for agricultural extension educators ($n = 213$)

Level of motivation...	Mean	SD
for work	4.20	.842
about leaning	3.66	.874

Scale: 1 = very low to 5 = very high

Correlation Analysis

Two items addressed relationships between agricultural extension educators' motivation and selected demographics. Correlation analysis was conducted to reveal the relationships between agricultural extension educators' education perceptions regarding water quality issues and age. The results indicate that they have negligible relations; as people advance in age their perceptions, particularly about water quality, decrease (Table 8). On the other hand, correlation analysis indicated that there was not a relationship between agricultural extension educators' education perceptions about the teaching-learning process and age (Table 8).

Table 8. Correlation coefficient between agricultural extension educators' perceptions regarding water issue, perceptions about the teaching-learning process, with age

Variable	Correlation	Significance
Perception on water quality	– .107	.124
Perception about the teaching / learning process	– .037	.594

Relationship between agricultural extension educators' motivation for work with factors that influence decision(s) for work and selected demographics

Agricultural extension educators were asked to indicate their level of self-perceived motivation for extension work and learning about water quality issues using a 5-point Likert-type range from 1 = very low to 5 = very high (Objective 6). Correlation analysis revealed there was a positive correlation between agricultural extension educators' motivation for learning about water quality issues and variables such as general perceptions about water quality, level of motivation, positive attitudes toward the program, professional commitment, technical competency, available technical support, personal satisfaction, recognition of work, and appreciation of work, administrative support, and extension council support.

There was a significant relationship between agricultural extension educators' motivation for their work and their perceptions regarding water quality and selected demographics (Table 8).

According to the Pearson coefficients, motivation for work was highly correlated with several factors related to work motivation in Part V of the questionnaire Q41-Q49 (Table 9). The Pearson coefficient between level of motivation for work and positive attitudes toward the program was highest (.528). The second highest correlation with the level of motivation for work by the respondents was professional commitment (.504), which explains that agricultural extension educators valued their professional commitment as water quality specialists (i.e., they are dedicated to their profession). The third highest correlation was in technical competency (.468). Agricultural extension educators believed that their technical competency was strongly tied to their motivation when dealing with water resource issues. Available technical support was fourth highest as a factor related to the respondents'

Table 9. Correlations of agricultural extension educators' perceptions regarding water quality motivation for work with factors that influence decisions for extension work with selected demographics

Variables	Pearson coefficient	<i>p</i> -value
Positive attitudes toward the program	.528*	< .001
Professional commitment	.504*	< .001
Technical competency	.468*	< .001
Available technical support	.419*	< .001
Personal satisfaction	.392*	< .001
Recognition of work	.383*	< .001
Appreciation of my work	.354*	< .001
Administrative support	.330*	< .001
Extension council interest	.295*	< .001
Degree	.083	.233
Gender	.037	.591
Age	.004	.955
Extension experience	.078	.258

Scale: 1 = very low to 5 = very high; * $p < 0.01$.

motivation for their work (.419). This implies that motivation regarding success in their work concerning water quality issues was strongly tied to available technical support. The remaining significant factors were personal satisfaction (.392), recognition for work (.383), appreciation for work (.354), administrative support (.330), and extension council support (.295). This hierarchy indicates a progression from intrinsic to extrinsic values, again

supporting the finding that water quality specialists are motivated more by their personal factors than by the opinions of others about their performance.

It is interesting to note that demographic factors of degree ($p = .083$), gender ($p = .037$), age ($p = .004$), and extension experience ($p = .078$) were not significant regarding perceptions and motivation for work. Clearly, demographics were not very strong indicators of motivation.

Relationship between agricultural extension educators' perceptions about water quality issues and their level of motivation for learning more about water quality (Q51)

Correlation analysis was conducted to reveal the relationships between agricultural extension educators' perceptions about water quality issues and the level of motivation for learning about water quality (Objective 7). The results of the Pearson correlations revealed there was a strong positive correlation between agricultural extension educators' general perceptions concerning water quality practices and their motivation for learning more about water quality issues (Table 10). The relationship between agricultural extension educators' educators about water quality and the level of motivation for learning about water quality was positive and highly significant.

Table 10. Correlations between agricultural extension educators' perceptions about water quality with the level of motivation for learning more about water quality

Variables	Pearson coefficient	p -value
Perceptions Regarding water Quality issues	.660*	.000
Level of motivation for learning about water quality (Q51)	1	.000

* $p < 0.01$.

Suggestions to Improve In-service Programs

The suggestions recommended by the respondents to improve in-service training programs for water quality issues are summarized Table 11, which is divided into 23 categories. These 23 categories were divided into six sub-categories based on the results which were ranked in hierarchical order based on the number of responses for each suggestion.

The first category involved two specific suggestions to apply specific methods to improve in-service programs. The first suggestion focused on the need to differentiate nutrient criteria for water from state to state in order to address issues concerning water quality issues in different locations within the North Central Region. Twenty-three respondents considered the necessity to clearly define nutrient criteria differences at different stages to address several conditions that are observable at a specific site or location. The next suggestion was indicated by 21 respondents favored the diffusion of an agricultural best practice, such as IPM, as being more a general educational process than a delivery of specific information about technology.

The next subcategory is related to suggestions for use of specific practices. There were 16 respondents who indicated that producers should be educated to use best management practices. Thirteen respondents suggested information about pesticide application would reduce risk of water contamination. Thirteen respondents indicated that agricultural practices related to water quality are beneficial to the whole community. Eleven other corresponds suggested that agricultural best management practices (BMP) are useful to improve water quality.

Table 11. Suggestions to improve in service training focused on water related issues

Suggestion	N
<i>Best IPM practices specific to a state's situation</i>	
1. Nutrient criteria for water should be different from state to state.	23
2. Diffusion of an agricultural best practice such as IPM is more a general educational process than delivery of specific information about technology.	21
<i>Use of best management practices</i>	
3. Producers should be educated to use best management practices.	16
4. Information about pesticide application would reduce risk of water contamination.	13
5. Agricultural practices related to water quality are beneficial to the whole community.	13
6. Agricultural best management practices (BMP) are useful to improve water quality.	11
<i>Involvement of learners</i>	
7 Demonstrations, hand on activities , anything that will increase the motivation to learn, you also need to involve the individual learners	9
8. Subject matter must be repeated several times; the adoption of best management practices is a gradual process for most producers. Practitioners need a lot of assurance that BMPs will not affect their profits.	7
9. More hands-on experience.	7
<i>Support for education at the local level</i>	
10. More research results and applications to teaching audiences	6
11. More support for professionals training specific to water quality	6
12. More USDA support for water quality education is needed	6
13. Information exchange between research and extension is needed	5
14. Including farmers in the decision-making process will give wide acceptance	5
15. Problem solving and case study are best ways to visualize farmers problems	4
<i>Use of best educational practices</i>	
16. For every education method there is a suitable learning situation	4
17. Is specifically designed to maximize the type of outreach or education effort to inform, communicate, educated formalized learning process.	3
18. Approach relies on the best practices suitable to that type of effort	3
19. Build thinking and reasoning skills – analysis, synthesis, evaluation, and problem solving – that learners can use to construct and apply their work	2
20. The use of indigenous knowledge by extension agents	2
<i>Takes a holistic approval to training</i>	
21. Provide training to increase skills needed to accomplish goals identified by the group	1
22. Take in consideration the community as a whole, including: socio- political , economic, historical, and cultural influence when addressing water quality issues	1
23. Match the target audience to the scale of the problem	1

The third subcategory is related to suggestions to include specific, effective teaching methods. Nine agricultural extension educators were in favor of introducing demonstrations, hand on activities, anything that will increase the motivation to learn, also need to involve the individual learners. Seven responds pointed out that subject matter must be repeated several times, the adoption of best management practices is a gradual progress for most producers. They need a lot of assistance that BMPs will not affect their profits. Seven respondents identified the need on hand on experience. Six respondents mentioned that more research results and applications to teaching our audiences.

The fourth subcategory is related to suggestions regarding use of research and collaboration involving water quality training efforts. Six agricultural extension educators suggested that more support is needed for professionals training specific to water quality. Six respondents thought that more USDA support for water quality education is needed. Five agricultural extension educators suggested information exchange between researchers and extension is needed. Five respondents' stated that including farmers in the decision- making process will give wide acceptance.

The fifth subcategory of suggestions involves teaching/learning methods/practices to increase awareness and knowledge related to water quality. Four respondents indicated that problems solving, case studies are best ways to visualize farmers' problems. Four agricultural extension educators found it necessary that for every education project suitable learning situation. Three respondents indicated that specially designed program will maximize the type of outreach or education effort to inform, communicate, and educated program to maximized learning process. Three respondents indicated that the approach relies on the best practices suitable to that type of effort. Two respondents mentioned that building thinking

and reasoning skills – analysis, synthesis, evaluation and problem solving – that learners can use to construct and apply their work. Two respondents were in favor of the use of indigenous knowledge by extension agents.

The last subcategory of suggestions involves the target group/audience. One respondent suggested to provide training to increase skills needed to accomplish goals identified by the group. One respondent mentioned to take into consideration the community as a whole, including, social-political, economic, historical, and cultural influence when addressing water quality issues. Finally, one respondent pointed out the need to match the target audience to the scale of the problem.

CHAPTER V. DISCUSSION

The central purpose of this study was to determine extension education professionals' perceptions regarding the teaching and learning process that focus on water quality issues related to agriculture practices. This research also sought to determine the relationship between agricultural extension educators' perceptions and their motivation for learning about water quality. Three hundred extension educator professionals were randomly selected from the target population in this study, which comprised the 12 states in the North Central Regions of the United States. This chapter presents a discussion of the main findings of the study based on each objective. The outcomes of the study would be valuable in designing an in-service model for training agricultural extension educators about at water quality issues.

The main objectives for the study were to:

- 1 Describe the demographic characteristics of the population;
- 2 Determine agricultural extension agents' perceptions regarding the principles related to teaching-learning processes focused on water quality issues;
- 3 Identify effective teaching tools and methods for providing education regarding agriculture practices related to water quality issues;
- 4 Identify the factors that limit agricultural extension educators learning about water quality practices;
- 5 Determine the extent to which specific factors influence agricultural extension agents' motivation for extension work;
- 6 Determine the relationship between the agricultural extension educators' motivation for their work based on demographic factors such as gender, age, level of education, and work experience (Q41-Q44);
- 7 Determine the relationship between the agricultural extension educators' perceptions about water quality issues and their level of motivation to learn more about water quality (Q50); and
- 8 Develop an in-service training model for extension an educator that focuses on water quality issues.

Demographic Characteristics

The majority of the respondents were male (85.4%), whereas slightly more than 10% (13.6%) of were female. The average age of agricultural educators was 47 years. One-fourth (24%) of the respondents were between 46-50 years of age, whereas less than 5% (3.9%) were less than 30 years old. Approximately 15% (16.9%) of the respondents were older than 50 years of age. Among the participants, the average number of years of professional experience in extension service was 16.5. This provides a good indication that most of the respondents in the sample were well informed and experienced agricultural extension educators.

The majority of the agricultural extension educators who participated in the survey sample had either Masters or Doctoral degrees (80.4%), while 19.5% of the respondents earned a Baccalaureate degree. The distribution based on level of education is a good indication that the respondents comprised a well-educated group of extension agents.

Nearly 30% (29.6%) of the agricultural extension educators involved in this study had majored in Animal Science. Approximately 20% (20.7%) had majored in Agronomy, and 20% (20.2%) were Agricultural Education majors. This comprised three-fourths of the participants. The remaining had majored in Horticulture (2.9%), or indicated they had “other” (non Agriculture disciplines (30%). Thus, the majority of the agricultural extension educators’ represented diverse interests and responsibilities.

Perceptions Regarding the Principles Related to Teaching and Learning Processes that Focused on Water Quality Issues

The second objective of this research was to determine agricultural extension agents' perceptions regarding the principles related to the teaching and learning processes that focus on water quality issues. There was unanimous agreement that the educational process by which the knowledge, attitudes and skills are changed must include the best learning and teaching practices.

The overall mean and standard deviation on perception on water quality issues were 3.82 and .608, respectively, which provided a good indication that agricultural extension educators had favorable perceptions regarding water quality issues. This finding regarding perception concurred with findings by Jayaratne (2001), who reported a positive attitude among agricultural extension educators in the North Central Region toward sustainable agriculture.

The overall mean and standard deviation regarding perceptions about the teaching and learning process were 3.86 and .668, respectively, which indicated that agricultural extension educators in the sample had favorable perceptions about the teaching and learning process.

Effective Teaching Methods and Tools for providing Education Regarding Agricultural Practices Related to Water Quality Issues

The third objective was to identify effective teaching tools and methods for providing education regarding agricultural practices related to water quality issues. The mean value of the six teaching methods items in the instruments indicated that agricultural extension educators in the sample had favorable attitudes toward effective teaching methods. The

highest mean value (4.36) was reported for the item “Demonstrations”, indicating that respondents were in agreement that this method was among the best teaching methods when addressing water quality issues. The second highest mean value (4.23) was reported for “one-on-one instruction”. Respondents indicated that this was also an effective method for teaching and learning about water quality agricultural technologies. The third highest value (3.52) was reported for “group discussion” as an excellent teaching and learning methods when addressing issues such as water quality that is agricultural related. The fourth highest value (3.24) was reported for “seminars” as an effective teaching method in teaching and learning about water quality agricultural technologies. These four methods are well-established in the literature as being effective methods for working with adults (Ferrier, 1992).

Professional agricultural extension educators perceived field days, study tours and workshops as effective teaching tools for providing educational programs about water quality agricultural technologies. The following printed materials and websites were perceived by respondents as second best option for best tools for providing educational programs regarding the teaching and learning about water quality agricultural technologies. However, agricultural extension agents perceived computer programs, video tape and slides as moderated effective in teaching. This implies that uses of effective tools are important in teaching to elevate knowledge skills, which are also essential in human development.

Istance et al. (2002) indicated the use of technology in education by instituting five technologies for educational change: systems thinking, systems design, quality science, change and management. These five essential disciplines must converge to solve the

problems of education together. They deal with the combination of tools, machines, electronic devices, people, process, management skills that need for effective restructuring.

Identify the Factors that Limit Agricultural Extension Educators Learning about Water Quality

The fourth objective of this study was to address the identifying factors that limit agricultural extension educators learning about water quality. Agricultural extension educators who participated in the study unanimously agreed that available time spent on research as well as spending more time with a specialist on water quality issues were very significant yet somewhat limiting factors for them to know more about the issues regarding water quality (M 3.88; SD 1.14). The second factor that respondents found to decrease their learning about water quality was clarity about the use of new agricultural technology (M 2.80; SD 1.10). The third factor in which respondents unanimously agreed upon was the training opportunities (M 2.77; SD 1.14). The fourth factor dealt with the opportunity to interact with researchers (M 2.75; SD 1.21), and networking opportunities (M 2.74; SD 1.13). The fifth and the sixth dealt with access to research information (M 2.59; SD 1.21), and access to instructional materials (M 2.74; SD 1.17).

It is clear that these factors are perceived by agricultural extension educators as essential in providing the background necessary for them to be knowledgeable experts in their field. Thus, a lack of knowledge would hinder their success in teaching about water quality issues in the field. Water quality issues in the Southern region are similar to those in other parts of the country even though environmental concern can be less intense where population densities are lower. Consequently, addressing environmental problems is often more difficult due to conflict with traditions of independence and self-reliance. Education is

the key to addressing issues, both for implementation of solutions and formulation of good public policy (Southern Rural Development Center, 1999).

Determine the Extent to which Factors Influence Agricultural Extension Agents' Motivation for Extension Work

According to Knoll (1985, p. 23), on a practical level, “motivation” is defined as a goal which people hope to achieve by behaving in a particular way. This definition is useful for curriculum planners for practice in adult education. On the other hand, motivation can also be defined as the willingness to expend energy on a particular activity, as the energizing force which sets behavior in motion rather than as the end result to which behavior is likely to lead to a success. Adult participation regarding teaching and learning about water quality should be understood, not as a matter of the expected benefits, but as the state of readiness or willingness to participate, regardless of the possible results of the activity in question. This definition explains how important it is to comprehend the impact of factors that can influence agricultural extension educators' motivation for extension work. In this study, agricultural extension educators perceived their positive attitudes toward the program as the most important factor that influenced their motivation and decision to conduct extension programs.

The second most influential factor that was found to highly motivate agricultural extension educators regarding their work was “My professional commitment,” followed by “involvement in extension work. The following factors available technical support, , technical competency, appreciation for work,, extension council interest , administrative support and recognition of work all are motivating factors for them to get involve in their programs but respondents classify them as moderately motivating factors for them to conduct successful work. Similar to this finding, Jayaratne (2001) reported the professional

commitment of agricultural extension educators' work as the most important motivating factor.

Correlations between Agricultural Extension Educators' Motivation for Work with Factors that Influence Decision for Work and Selected Demographics

In the sixth objective, correlation analysis revealed that there was a strong positive correlation between agricultural extension educators and factors that influence their decision for work. The Pearson correlation listed the following as the most influential factors that drive agricultural extension educators' motivation and decision for extension work.

Agricultural extension educators in this study on water quality perceived that positive attitudes toward the program, professional commitment, available technical support, personal satisfaction, and appreciation of my work as highly motivating factors for them to get involved in extension programs. Participants also perceived that the least influential factors were: administrative support and extension council as the least desirable features of agricultural extension educators' work.

The above factors are a good indication that agricultural extension educators in the North Central Regions during this specific study were driven by intrinsic motivation to get involve in extension programs.

These variables correlated positively with the following demographics: degree (1.92), gender (1.14), age (47.07), extension experience (16.50) and level of motivation that they have for work (4.20).

Determine the Relationship between Agricultural Extension Educators' Perceptions about Water Quality Issues and the Level of Motivation for Learning More about Water Quality

Correlation analysis revealed there was a strong positive correlation between agricultural professionals' perception on issues regarding water quality issues and the level of motivation they have for learning more about water quality. The Pearson correlation coefficient was .660, indicating that there was a strong positive correlation between these two variables although keeping in control the influence of the other correlating variables such as motivation for work, number of in-service training programs, and level of education. The findings indicate the stronger the perception toward water quality issues, the higher the motivation for learning about water. Parallel to this finding, Jayaratne (2001) reported that when extension agents were motivated about sustainable agriculture and were willing to learn more about it, their interest and concern about issues related to water quality were high. This may be the determining factor for a strong positive correlation between motivation and perception, and motivation for learning regarding water quality issues.

Development of a Model for Teaching about Water Quality Issues

A model on teaching about water quality issues was developed based on research conducted in this study (Figure 1). The main components of the model are described in the following subsections.

Program goals and objectives

The findings of the study will be applied for establishing appropriate in-service programs based on effective use that considers the needs of the learners. Addressing the needs of the program would take into consideration the needs of agricultural extension

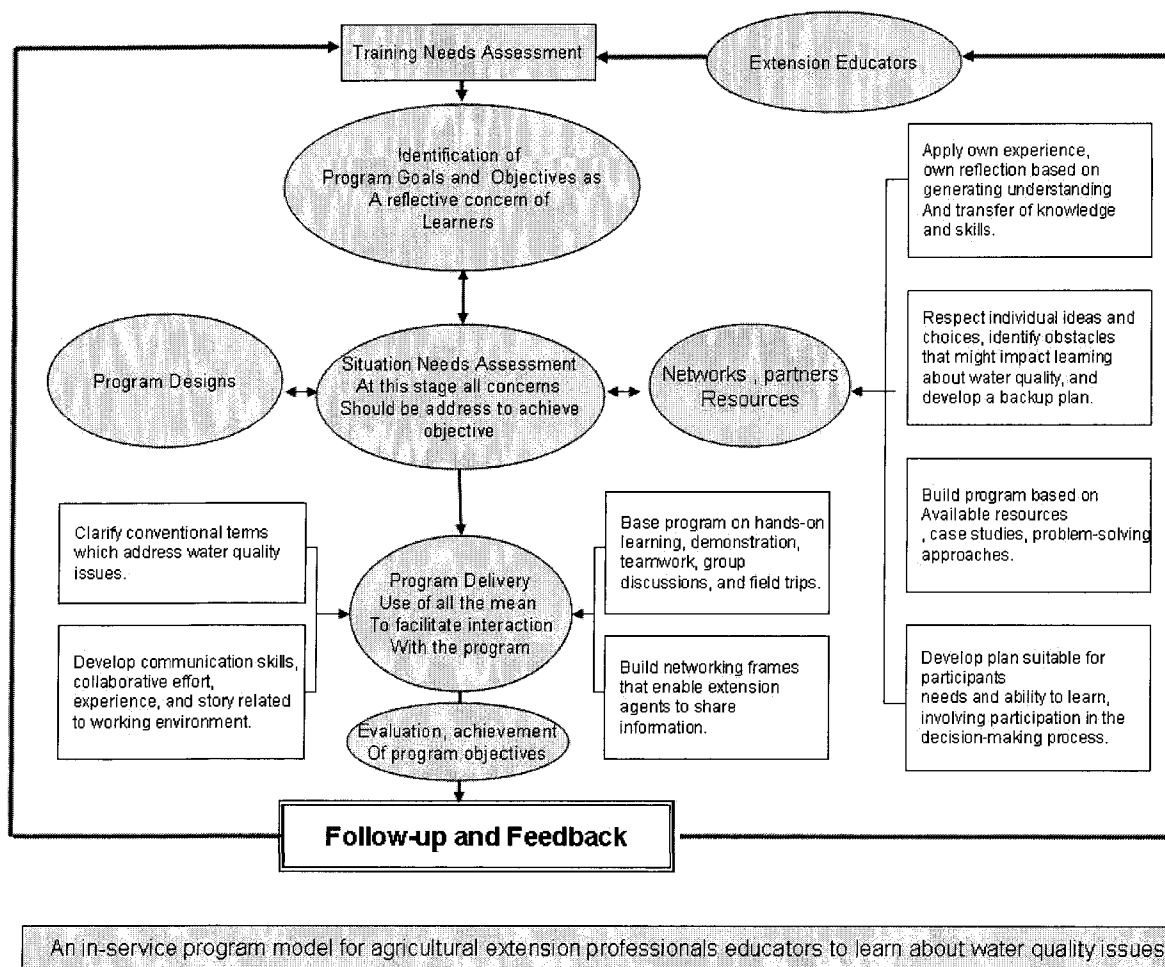


Figure 1. An in-service program model for agricultural extension educators to learn about water quality issues

educators and the target audience to make the training model meaningful. Addressing the needs of agricultural extension educators and the target groups will be the first canal, followed by identifying the learning goals and objectives to meet the training needs. For each education or learning situation which is in the early stages, there should be a specifically designed model to maximize the type of outreach or education effort and enhance group or community skills. Participants are very favorable to demonstration as a best practice suitable to this type of effort.

According to Andrews et al. (1995), a good organized and well planned education program or outreach helps to ensure not only about a ways to accomplish one's goals and objectives but also provides an opportunity to the resources that are already available, what is needed, and what one's target audience wants and needs. Finally, the process helps one to determine whether or not the project goals have been accomplished.

Networks, partners, and resources

Learning objectives should be addressed by clearly defining water quality issues to establish an educational program that addresses both the needs of the extension educator and the learners. Learning goals and objectives should adequately reflect the agricultural extension educators own experiences and their own reflections based on generating understanding and transferring skills and knowledge. It is also beneficial to identify the issues that might positively influence the learning process about water quality.

This study revealed that availability of time, clarity about the use of new agricultural technology, and training opportunities were among some of the findings that impacted positively respondents to be highly involved about learning about water quality issues. Respondents were able to bring forth issues that limit learning about water quality practices, such as barriers that limit access to instructional materials and access to research information. There is also a need to respect each individual's ideas and choices as well as to identify obstacles that may impact adult learning about water quality. In some cases a backup plan should be developed that addresses possible barriers in case one arises.

Adult learning style requires being specific, thus, the program should involve the participants in specific leaning situations that comprise the real world in which they must

cope on a daily basis. This is the environment in which adults best learn, perform, and interact with other learners. Working with real issues in a particular environment should give the learners the opportunity to participate in their own decision-making at each stage of the program and to develop effective strategies to deal with water quality related issues locally. Therefore, communication and delivery measures are needed that address the personal needs of the learners and their environment, to assist them to better comprehend multilateral problems of water quality in their locality, particularly the individual and collective roles people need to play to address and resolve water issues they face on a daily basis.

During the initiation of the program stage, making a plan suitable for adult needs and abilities to learn should involve the learner's participation in the decision-making process. The program development should be focused on the findings that reflect the environment of the adult learners and the education program that must be provided. In this study, the participants reveals that, in order to learn successfully about issues related to water quality, the program needs to provide them with adequate tools and suitable methods. Therefore, it is necessary to provide appropriate instructional materials and methods to maximize adult education.

Program design

The training should utilize effective instructors and a good instructional design that enables agricultural extension educators' to better understand and apply principles in real life situations. The training should provide effective management programs, a good facility or location, and appropriate scheduling for the training sections. The training or workshops program should follow the principles of program planning established in the research

literature, and planning should be flexible and based on the needs of the participants. Care should be taken to involve participants in the decision-making process for program design. The program should maintain positive relationships and supportive environments as well as enhance success in the learning environments. The focus should be practical based on real life situations, with monitoring of participants' reaction and learning to keep their motivation high (Andrews et al., 1995).

Program delivery

The delivery channel facilitates learners to cope with the program with suitable mechanisms based on educational program which are already in place. At this level effective teaching tools and methods are helpful for the success of the delivery channel to reach adults learners and agricultural extension educators in charge of diffusing vital information. Respondents in this study revealed that teaching methods such as demonstration, one-on-one instruction, and group discussion are suitable and effective in addressing issues regarding water quality agricultural technologies. When addressing teaching tools, the study revealed that field days, study tours, and workshops are among the best tools when addressing teaching and learning about water quality agricultural technologies. There is also the need for clarification by use of conventional terms which address water issues. Printed materials and web sites as well as computer programs were pointed out by the respondents as somewhat effective teaching tools. On the other hand use of video tapes, slides and "other" were considered as non-effective teaching tools.

The term "water quality" is major issue that has had a negative effect on learning regarding water quality issues. Previous research by Jayaratne (2001) supported this finding

in the context of sustainable agriculture. Therefore, it is necessary to build a program that provides a clear indication of water-related issues impacting negatively on the quality of the participants' own water and environment. Building networking frames enable extension agents to share information that will help learners to understand and use the best educational programs regarding maintaining water quality in the future.

This study revealed that agricultural extension educators' perceptions regarding water quality issues and the level of motivation they have for learning more about water quality were highly correlated. This result provides a good indication that respondents have favorable perceptions toward water quality, and these determining factors can be considered as a unavoidable when engaging learners to become motivated to engage in the learning process. Respondents pointed out a series of activities suitable for the success of the program, such as programs based on hands-on learning, demonstration, team work, group discussions, and field trips.

Development of communication skills, collaborative effort, experience and telling story which relate to the working environment, are vital to enable participants to engage in a mutual learning process leading to successful comprehension of their environment and the issues at hand. Therefore, the ideal environment during the delivery process is to make the work environment suitable for each participant.

Program evaluation

Program evaluation should be divided into easy steps at manageable stages according to the level of understanding of the learners. Respondents in this study indicated that program evaluation is a necessity which should follow the progress of the program at different stages.

The participants should see program evaluation as a canal of reflection from the beginning stage to advanced levels to determine if the program is achieving and addressing its learning goals and objectives. A good program builds thinking and reasoning skills of analysis, synthesis, evaluation, and problem solving that learners can use to construct and apply their own knowledge. Therefore, it is valuable to design evaluation systems that enable respondents to gain from the program that will positively benefit their education goals. It is very important to touch base with the environment of the learners, especially their every day concerns regarding issues related to water quality issues.

Follow-up and feedback

In the last stage, findings, suggestions, reflections on obstacles and issues that were not addressed and clarified at different stages should be address and used as a guideline to build follow-up activities to motivate and encourage participants to address problems of concern. The concerns and suggestions of participants at all levels should be revised and be included in the needs assessment and decision-making process that is studied for further program implementation and development The access of information and participation of all the changes should be addressed in a synergistic environment based on cooperation and collaboration efforts of all participants in the planning system.

The follow-up and feedback should be addressed in the last stage to provide valuable information for agricultural extension educators. These steps provide impetus for revision and changes that should be made or addressed for future concerns regarding program development.

CHAPTER 6. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to determine agricultural extension educators' perceptions regarding the teaching and learning process related to water quality, and determine the relationship between agricultural extension educators' perceptions of importance and their level of motivation for learning about water quality. The study viewed the importance of designing an in- service training model for agricultural extension educators' focus on water quality agricultural practices.

The objectives of the study were:

1. Identify agricultural extension agents' perceptions about water quality issues.
2. Identify agricultural extension agents' perceptions regarding the principles related to teaching-learning processes focused on water quality issues.
3. Identify effective teaching tools and methods for providing education regarding agriculture practices related to water quality issues.
4. Identify the factors that limit agricultural extension educators learning about water quality practices.
5. Determine the factors that influence agricultural extension agents' motivation for extension work.
6. Determine the relationship between the agricultural extension educators' perceptions about water quality issues and their level of motivation for learning more about water quality.
7. Develop an in-service training model for agricultural extension educators focused on water quality issues.

The agricultural extension educators in the 12 states North Central Region of the United States with an approximate an important number of agricultural extension educators. A stratified random sample of 300 agricultural extension educators was selected from the

study population. There was a 71% return rate for the email questionnaire. The findings were based on 213 completed questionnaires.

The original plan to send the survey to the county level of the agricultural extension educators was based on consideration that the communities at the county level are those practicing intensive corn and soybean production. Addressing water quality educational issues is a concern of the farming community at this level.

The second plan was to consider the county level as the grass roots level. Participation in the survey by these agricultural extension educators would balance water quality concerns both at the university levels and the county level. The reason was to inject fresh ideas from outside the university.

An email questionnaire was used to collect data for the study. There were six main sections in the instrument related to the specific objectives of the study. The validity and reliability study of the instrument were assessed by conducting a pilot study that mainly focused on extension professional educators. The Cronbach reliability coefficient for the specific parts of the instrument ranged from .80 to .96, ensuring the instrument was adequate and reliable for the study.

For the pilot study, two agricultural extension educators were selected from each of the 12 states in the North Central Region. Twenty-three of these respondents responded to the pilot study survey, with a return rate of 92%, which established the external validity of the study. The county agricultural extension educators were randomly selected. The names were obtained with the help of the Iowa State University Extension Program. The first results from the pilot- test for some questions which were negatively stated had very low Cronbach values: perceptions regarding water quality issues (.365), and the teaching process (.542).

When the questions were reversed to positive statements, the Cronbach values were acceptable: perceptions regarding water quality issues (.801), and the teaching process (.801).

The SPSS computer software package was used to analyze the data. Means, standard deviations and correlation analysis were applied to perform the data analysis based on the objectives of the study.

Demographics revealed that the majority of respondents in the study were male (85.4%), and the remainder (13.6%) female. The mean age of respondents was 47 years. The respondents experience in extension work varied from less than 1 year to 42 years. The highest educational achievement of the respondents was a Master or Doctoral degree. The majority of the respondents had a background in related Agricultural areas of animal science, agricultural education, agronomy, and horticulture. The majority of respondents had attended more than four in-service training programs related to water quality issues.

Agricultural extension educators who responded to the survey indicated the overall perceptions about water quality issues by responding to a seven-part survey that was emailed to them. Each part consisted of eight positive and two negative statements regarding water quality related issues. A five-point Likert-type scale, ranging from 1=strongly disagree to 5=strongly agree, was used to determine the perceptions of the participants. Negative statements with reversed values were recoded to be positive statement to determine overall perceptions regarding water quality issues.

The findings revealed the respondents' overall perceptions about water quality were of great concern. The respondents also agreed that protecting water and environment was an important concern. They mentioned that the long-term benefit of education programs and full participation in the decision-making process engendering change will be their priority in the

future. The concerns regarding perceptions of agricultural extension educators regarding water quality issues were very constant, regardless of gender, age, level of education, subject matter, time in service, or number of in-service programs focusing on water quality.

Perceptions regarding issues related to teaching-methods and tools regarding problems in water quality were obtained based on five-point Likert-type scale, ranging from 1= not very effective to 5=very effective. Respondents pointed out that a successful program on water quality issues should include the environment in which participants live, learn, and perform daily. Thus, to have positive outcomes, the focus of the teaching and learning for the targeted audience should be built on understanding the skills and interests of the participants.

The respondents in this study favored demonstrations, an effective teaching method and tool that promotes active engagement and involves real world problem solving. One-on-one instruction and group discussions enable the learners to link new knowledge to their existing knowledge in meaningful ways. The respondents also indicated that field days, study tours, and workshops provide good ways to communicate that are informative and enhance group and community skills. These approaches rely on best practices suitable to teaching and learning about water quality related issues.

The respondents unanimously agreed that a follow-up to training programs is necessary to help participants trace, and reflect where they are coming from, where they are, and where they are going. This process helps build thinking and reasoning skills of analysis, synthesis, evaluation, and problem solving. It also enables the learners to construct and connect their knowledge. The respondents indicated that video-tapes and slide projections were not effective teaching tools in educating about water quality. There was moderate agreement that short-term goals were a good indicator of the success of the program.

Participants in the program unanimously agreed that availability of time was the most limiting factor that impact negatively on learning about water quality issues. Clarity about the use of new agricultural technology, training opportunities, opportunity to interact with researchers, networking opportunities, access to recherche information and access to instructional materials were mentioned as some what limiting factors in learning about water quality issues. Other factors which were specified by some of the respondents included very noticeable factors that can also negatively impact the learning ambitions about water quality, such as economic status of the project, lack of team work, lack of motivation, the amount of area that one extension agent should cover, lack of educational materials and lack to support for government agents (EPA, USDA).

Agricultural extension educators' perceptions identified the factors that influence their decision and motivation for conducting extension programs by using a five-point Likert type scale ranging from 1=very low to 5=very high. Participants indicated that positive attitudes toward the program as well as professional commitment as very highly motivating factors for conducting extension work. Personal satisfaction, available technical support, technical competency, appreciation for their work and extension council interest were classified by respondents as high motivating factors when addressing issues about water quality issues.

Correlation analysis was performed to determine the factors that could influence other variables and link them to the correlation between the extension professional educators' general perceptions regarding water quality issues and their motivation for learning about water quality issues. Correlation analysis showed there was a strong positive correlation between extension professional educators' motivation for learning about water quality and

variables such as general perception about water quality and the level of motivation for work, years of experience in service, and training assisted. The correlation analysis also showed that there was a strong and highly significant positive correlation between agricultural extension educators' general perceptions regarding water quality and their level of motivation for learning more about water quality.

Limitations

There were several limitations to the study which might affect interpretation of the findings. The study was limited to the North Central Region of the U.S. and the perceptions of Agricultural extension educators regarding water quality issues. Because the survey was emailed to participants, the study was also limited only to the perceptions of the Agricultural extension educators who had access to computers, a current email address, and their names and email addresses were updated in the list of the 2005 directory of Agricultural Extension Educators in the North Central Region. There were issues of spam and lack of recognition of this researcher that blocked access to several people on the list. There were also issues of non-response related to people who did not read their email messages. These factors could have skewed the results according to the demographics. Some older agricultural extension educators do not use email, thus, a valuable source of perceptions was also eliminated in the results.

The study was limited to the use of quantitative analysis to determine perceptions of the respondents. Although there were some responses that required a short answer, the majority of the survey was based on responding via use of a 5-point Likert-type scale, limiting responses from low to high. In addition, to make the survey doable within a time

allotment of 10 to 15 minutes, many of the items had to be shortened that might have altered their meaning.

Conclusions

The conclusions of the study are based on the findings as they relate to the review of the literature regarding Agricultural extension educators, the targeted population, and water quality issues affecting people who reside in the North Central Region of the United States. To establish a successful program regarding water quality issues in the NCR in the United States, it is valuable to know, based on the findings of this study, that agricultural extension educators are more driven by intrinsic values such as positive attitudes toward the program, personal commitment, personal satisfaction, available technical support and the people they serve, but they are not driven by the extrinsic value or support from the administration such as recognition for work, administrative support, extension council support etc.

Respondents unanimously agreed that demonstrations, one-on-one instruction, followed by seminars are very useful methods in teaching and learning about water quality agricultural technologies. Field days, study tours should also be used for learning and teaching about water quality agricultural technologies.

Coming from an agricultural engineering background, this researcher truly believes that agricultural education provides the best way to impact teaching and learning about water quality issues. Agricultural engineering professionals should use agricultural education methods to communicate better and provide a greater likelihood for successful results in terms of practical and useful knowledge gained by the participants.

The high internal intrinsic factors influencing motivation was found in this study revealed that agricultural extension educator in the North Central Region of the U.S are not driven as much by administrative support for their work they are by their own positive attitudes towards the program and professional commitment for internal justification for their own sustained efforts at teaching and learning about water quality issues. Correlation analysis showed that there was a positive correlation between agricultural extension educators' motivation for learning about water quality issues and variables such as general perceptions, level of motivation, positive attitudes toward the program, professional commitment, technical competency, available technical support, personal satisfaction, and recognition for work.

Recommendations

The following recommendations were made based on the outcomes of this study:

1. To improve the learning experience for participants educational, programs need to be designed specifically to address the type of outreach or educational effort and the background of the participants.
2. Educational programs need to address a specific water quality issues for a given area within a region.
3. Programs involving agricultural extension education programs involving agricultural extension education professionals should be based on professionals should be based on intrinsic motivation rather than administrative recognition.
4. Demonstration, one-on-one activities, and seminars are the most effective methods to involve participants in learning about water quality issues. Therefore, it is wise to

develop educational activities based on demonstrations, and hands-on activities that will increase motivation to learn and evolve individual learners.

5. Study tours, workshops, and printed materials are among the most efficient tools in teaching about water quality agricultural technologies. Therefore, they should be included when appropriate.
6. Lack of sufficient time to perform the work was mentioned by respondents as limiting factors when learning about water quality issues. Thus, clarity about the use of new technologies and providing for interaction with researchers should be practices applied when teaching and learning about water quality issues.
7. Hands-on experiences and applying research results and applications to teaching audiences are valuable in new learning situation and should, thus, be applied often.
8. More support should be given by the USDA and EPA for water quality education programs to enable a greater focus on technical aspects of water quality as an integral part of sound educational programs regarding water quality issues. In other words, good teaching requires providing up-to-date equipment for use by both the agricultural extension educators and the participants.
9. The agricultural extension educators valued their positive attitudes toward the program as strong factors in their motivation and professional commitment to perform and be successful at their work. Therefore, it is very important to recognize and appropriately reward those who are successful at doing their work.
10. This study did not address in depth, the in-service of agricultural extension educators in the NCR, thus additional research should be considered to address in-service-training for agricultural extension educators.

Further Research

The following recommendations are made for further research based on the outcomes of the study:

1. This study pointed out the relationship between perceptions regarding water quality issues and the respondents' level of motivation for learning more about water quality in the North Central Region of the United States. Further research is needed to more fully understand and clarify the factors revealed in this study and how they influence perceptions and learning motivation.
2. Further research could address issues concerning water quality problems and lead to the design of strong educational program to assist participants to understand and apply the best educational techniques, tools, and methods.
3. A similar study should be conducted in a different zone in the United States regarding the perceptions of agricultural extension educators' perceptions on water quality. This might validate the current study as well as bring about different issues and needs of educators and learners in other regions.
4. Conducting a survey by email should include previous contact with agricultural extension educators and expectations about receiving the researcher's email to avoid rejection or spam issues.

Implications and Educational Significance of the Study


The main purpose of this study was to identify agricultural extension educators regarding the teaching and learning processes related to water quality agricultural practices with implications for agricultural education. The present study took place in the North

Central Region of the United States; the results reflect the perceptions of the agricultural extension educators in the specific location regarding water quality issues. The findings suggested that successful learning and teaching will occur when there is a strong education program in place. There was unanimous agreement by the agricultural extension educators in the region that demonstrations, hands-on practice, and interactions with researchers are among the best and most efficient ways to teach and learn about issues regarding water quality.

Focusing on learning goals and objectives that are a reflection of the participants' own experiences, based on generating understanding and the transfer of skills and knowledge, will be helpful to identify issues that have a positive influence on learning about water quality issues. Therefore, it is important to design educational experiences that enable respondents to gain from the program and apply what is learned in terms of actual experience. It is important to include the environment of the learners and their daily concerns regarding learning when teaching about issues related to water quality.

Good, potable water is a major issue today. This implies that addressing concerns about quality issues are important concerns to be viewed at a broad perspective. This study valued the application and need of educational support to enable water quality programs to succeed. Intrinsic motivation may be a solution but it is necessary to add other aspects to the teaching/learning experience such as addressing needs, learning styles, and the best, most useful methods and tools as change elements which constitute extension professional agricultural educators as well the learners to prepare the learners to accept change.

APPENDIX A. HUMAN SUBJECTS APPROVAL

	Modification Approval Date <u>2/11/05</u>	IRB FEB 28 2005
	Continuing Review Approval Date _____	
	Approval Expiration Date: _____	

ISU HUMAN SUBJECTS CONTINUING REVIEW AND/OR MODIFICATION FORM

TYPE OF SUBMISSION: ☐ Continuing Review ☒ Modification ☐ Continuing Review and Modification

Principal Investigator: <u>ERERER Mohamed Camara</u>		Phone: <u>294 4349</u>
Degree: <u>PhD</u>	Correspondence Address: <u>223 Curtiss Hall Iowa State University</u>	
Department: <u>ER Agricultural Education & Studies</u>		E-mail Address: <u>mcamara@iastate.edu</u>
Project Title: <u>Water Quality Education in the North Central Region</u>		
IRB ID: <u>04-288</u>	Date of Last Continuing Review: <u>02/25/05</u>	
IF STUDENT PROJECT		
Name of Major Professor: <u>Dr. Robert A. Martin</u>		Phone: <u>515 294 5904</u>
Department: <u>Agricultural Education & Studies</u>		Campus Address: <u>201 Curtiss Hall Iowa State University</u>
		<u>Ames, IA 50011</u>
		E-mail Address: <u>drmartin@iastate.edu</u>

FUNDING INFORMATION:

<input type="checkbox"/> External Grant/Contract	<input type="checkbox"/> Internal Support (no specific funding source) or Internal Grant (indicate name below)
Name of Funding Source: _____	OSPA Record ID on Gold Sheet: _____
<input type="checkbox"/> Part of Training, Center, Program Project Grant – Director:	Overall IRB ID No: _____

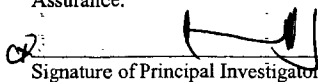
CONFLICT OF INTEREST

The proposed project or relationship with the sponsor require the disclosure of significant financial interests that present an actual or potential conflict of interest for investigators involved with this project. By signing this form, all investigators certify that they have read and understand ISU's Conflict of Interest policy as addressed by the ISU Faculty Handbook and made all disclosures required by it. (<http://www.provost.iastate.edu/faculty>.)

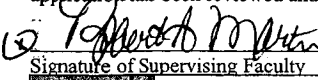

Do you or any member of your research team have a conflict of interest? ☐ Yes ☒ No
If yes, has the appropriate disclosure form been completed? ☐ Yes ☐ No


ASSURANCE

I certify that the information provided in this application is complete and accurate and consistent with proposal(s) submitted to external funding agencies. I agree to provide proper surveillance of this project to insure that the rights and welfare of the human subjects are protected. I will report any adverse reactions to the IRB for review. I agree that modifications to the originally approved project will not take place without prior review and approval by the Institutional Review Board, and that all activities will be performed in accordance with state and federal regulations and the Iowa State University Federal Wide Assurance.

 2/28/05
Signature of Principal Investigator Date

Student Projects: Faculty signature indicates that this application has been reviewed and is recommended for IRB review.

 2/28/05  3/11/
Signature of Supervising Faculty Date IRB Approval Signature Date

	EXPEDITED per 45 CFR 46.110(b) _____, Category _____, Letter _____
	STUDY REMAINS EXEMPT per 45 CFR 46.101(b) <u>2</u>
	WAIVER of SIGNED CONSENT per 45 CFR 46.117(c) _____
	WAIVER of ELEMENTS of Consent per 45 CFR 46.116 _____
	VULNERABLE POPULATION per 45 CFR 46. _____

APPENDIX B. WATER QUALITY ISSUES SURVEY

Agricultural extension educators' perceptions regarding the teaching and learning process related to water quality issues in the North Central Region of the United States



Iowa State University

Ames, 2005

I – Perceptions Regarding Water Quality Issues

Please indicate your level of agreement with each of the following statements about water quality by circling the appropriate number on a 5-point scale (1=Strongly Disagree to 5=Strongly Agree).

Perceptions	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
1. Water quality is a major issue.	1	2	3	4	5
2. There are more pollutants in drinking water today than there were 25 years ago.	1	2	3	4	5
3. People need more education about water quality issues.	1	2	3	4	5
4. Excessive use of fertilizers contributes to water pollution.	1	2	3	4	5
5. Sharing information regarding water quality with your community is important to you.	1	2	3	4	5
6. Water contamination from chemicals has affected my family.	1	2	3	4	5
7. Producers should attend fertilizer and manure management clinics to gain knowledge to protect water quality.	1	2	3	4	5
8. Excess nutrients pose a serious threat to surface as well as ground water.	1	2	3	4	5
9. Information about pesticide application would reduce risk of water contamination.	1	2	3	4	5
10. Nutrient criteria should be different from state to state.	1	2	3	4	5

II – Perceptions about the Teaching-Learning Process

Please indicate your level of agreement with each of the following statements about the teaching-learning process (*The educational process by which knowledge, attitudes and skills are changed.*) as it impacts acceptance of new agricultural practices such as integrated pest management (IPM) by circling the appropriate number on a 5-point scale (*1=Strongly Disagree to 5=Strongly Agree*).

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
1. Training programs should be built around the target participants' needs and interests to derive a positive learning outcome.	1	2	3	4	5
2. A systems approach is the best way to construct a meaning when learning about water quality improvement.	1	2	3	4	5
3. Experiential educational programs are effective in learning about water quality improvement.	1	2	3	4	5
4. The problem solving approach is very effective in teaching about water quality improvement.	1	2	3	4	5
5. Change of attitude is the most difficult learning outcome to reach in teaching water quality improvement.	1	2	3	4	5
6. Evaluation of extension training should be based on the accomplishment of the participants' learning objectives as identified by the participants.	1	2	3	4	5
7. Follow-up to training programs is necessary to help participants to resolve issues and concerns about water quality improvement.	1	2	3	4	5

III – Limitations to Learning about Water Quality Practices

To what extent do the following factors limit your learning about water quality practices? (Please circle the appropriate number, 1=Not at all to 5=Very Much)

	1 Not at all	2 Very	3 Somewhat	4 Much	5 Very Much
1. Access to instructional materials.	1	2	3	4	5
2. Access to research information.	1	2	3	4	5
3. Opportunity to interact with researchers.	1	2	3	4	5
4. Clarity about the use of new agricultural technology.	1	2	3	4	5
5. Training opportunities.	1	2	3	4	5
6. Networking opportunities.	1	2	3	4	5
7. Availability of time.	1	2	3	4	5
8. Other (Specify) _____	1	2	4	4	5

IV – Teaching Methods and Tools

How effective is each of the following teaching methods and tools in teaching and learning about water quality agricultural technologies? (Please circle the appropriate number, 1=Not Very Effective to 5=Very Effective)

	1 Not Very Effective	2	3 Somewhat Effective	4	5 Very Effective
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Teaching Methods

a. Group discussions	1	2	3	4	5
b. Lectures	1	2	3	4	5
c. Seminars	1	2	3	4	5
d. One-on-one instruction	1	2	3	4	5
e. Demonstrations	1	2	3	4	5
f. Other (Specify) _____	1	2	3	4	5

Teaching Tools

a. Field days	1	2	3	4	5
b. Study Tours	1	2	3	4	5
c. Workshops	1	2	3	4	5
d. Video tapes	1	2	3	4	5
e. Slides	1	2	3	4	5
f. Computer programs	1	2	3	4	5
g. Printed materials	1	2	3	4	5
h. Web-sites	1	2	3	4	5
i. Other (Specify) _____	1	2	3	4	5

V – Motivation

To what extent do the following factors influence your motivation for conducting extension programs.
(Please circle the appropriate number, 1=Very Low to 5=Very High)

	1 Very Low	2 Low	3 Moderate	4 High	5 Very High
1. My technical competency	1	2	3	4	5
2. Appreciation of my work	1	2	3	4	5
3. Recognition of my work.	1	2	3	4	5
4. Administrative support	1	2	3	4	5
5. Extension council interest	1	2	3	4	5
6. Available technical support	1	2	3	4	5
7. Personal satisfaction	1	2	3	4	5
8. My professional commitment	1	2	4	4	5
9. My positive attitudes toward the program	1	2	3	4	5

Other motivation

1. Indicate the level of motivation that you have for your work.	1	2	3	4	5
2. Indicate the level of motivation for learning more about water quality.	1	2	3	4	5

VII – Demographic Information

- What is your age? _____ Years
- What is your gender? (a) Male (b) Female
- What is your highest educational attainment?
(a) B.S. (b) M.S. (c) Ph. D.
- What was your undergraduate major?
(a) Agronomy (b) Animal science (c) Horticulture (d) Agricultural Education
(e) Other (Specify) _____
- How many years of experience do you have in the extension service? _____

6. What best describes your area/areas of extension responsibility? (Please check all that apply to you)

- ☐ Crops
☐ Horticulture
☐ Livestock
☐ Natural resources
☐ Community Development
☐ Youth & 4-H
☐ Administration
☐ Others (please specify) _____

7. How many times have you attended in-service training programs related to teaching about water quality during the last five years? _____

VIII – Suggestions to Improve In-service

1. What specific suggestions do you have to improve in-service training programs on teaching about water quality?

2. General comments

Thank you for taking part in the survey. We appreciate your time and contribution in this study.

Please send your questionnaire to following email address.

Mohamed Camara

Graduate Student

mcamara@iastate.edu

Robert A. Martin

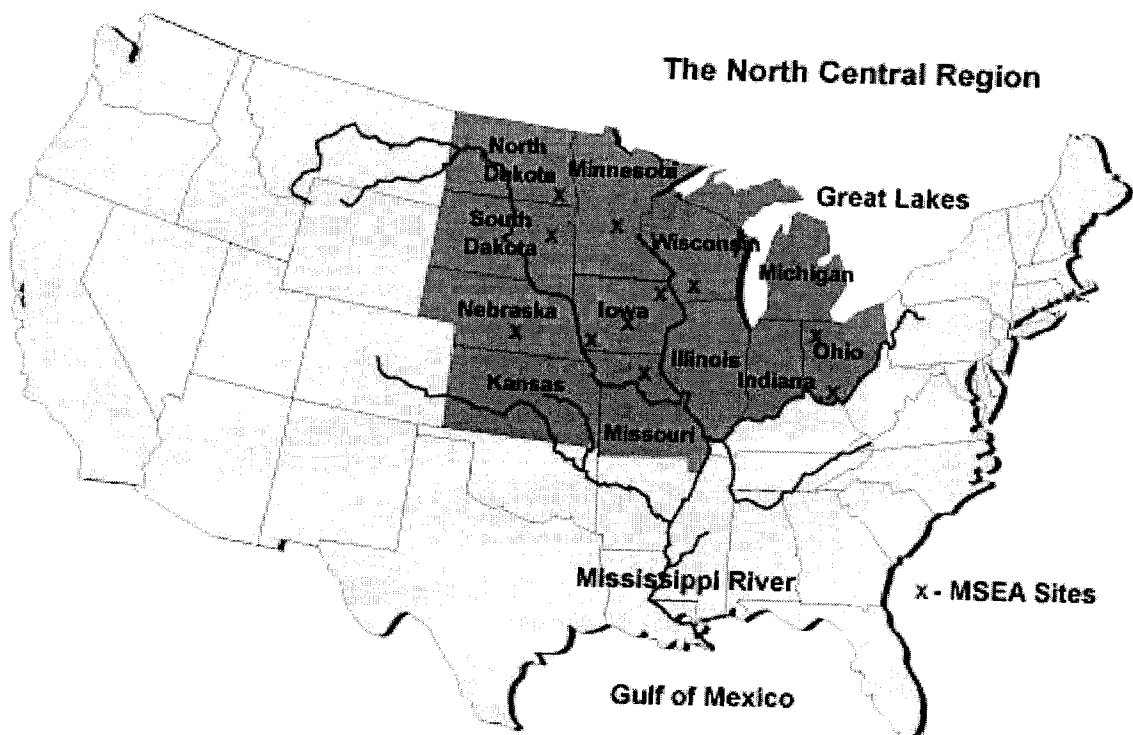
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REFERENCES

- Allport, F. H. (1955). *Theories of perception and the concept of structure: A review and critical analysis with an introduction to a dynamic-structural theory of behavior*. New York: John Wiley & Sons, Inc.
- Alexander, B. K., Anderson, G. L. & Gallegos, B. P. (2005). Mahwah, NJ: Ehrlbaum & Associates h
- Andrews, E., Farrell, E., Heimlich, J., Ponzio, R., & Warren, K.. (1995). *Educating young people about water: A guide to program planning and evaluation*. ERIC/CSREE: The Ohio State University and the University of Wisconsin Environmental Resources Center. Retrieved 10/20/2005, from <http://www.uwex.edu/erc/ey paw>
- Ary, D., Jacobs. L. C, & Razavieh, A. (1996). *Introduction to research in education* (5th ed). New York: Harcourt Brace.
- Ary, D., Jacobs. L. C, & Razavieh, A. (2002). *Introduction to research in education* (6th ed). New York: Harcourt Brace.
- Banathy, B. H. (1973). *Developing systems view of education: The systems-model approach*. Belmont, CA: Siegler, Publishers.
- Bajema, D. H., Miller, W. W., & Williams, D. L. (2002). Aspirations of rural youth. *Journal of Agricultural Education*, 43(3), 61-71.
- Barker, L. M. (1997). *Learning and behavior: biological, psychological, and socio cultural perspectives* (2nd ed.). Upper Saddle River, NJ: Prentice Hall.
- Barbuto, J. E. (2001). Understanding and applying an integrative taxonomy of motivation sources to professional and personal settings. *Journal of Management Education*, 25, 713-725.
- Barbuto, J. E., Fritz, S. M., & Marx, D. (2000). A field study of two measures of work motivation for predicting leaders' transformational behaviors. *Psychological Reports*, 86, 295-300.
- Baron, W. L. (1973). Systems analysis and teacher education. In D. W. Anderson, J. M. Cooper, M. V. De Vault, G. E. Dickson, C. E Johnson, & W. A. Weber (Eds.), *Competency based education* (pp. 15-31). Berkeley, CA: McCutchan Publishing Corp.
- Barrow, C. J. (1987). *Water resources and resources and agricultural development in the tropics*. New York: Wiley & Sons.

- Belanger, P., & Valdivielso, S. (1997). *The emergence of learning societies: Who participates in adult learning?* Tarrytown, NY: Pergamon Press and the UNESCO Institute for Education.
- Belbin, R. M. (1965). *Employment of older workers: Training methods*. Paris: OECD Publications.
- Bernard, L. R. (1980). *Adult learning*. New York: Halsted Press.
- Biner, P. M., Dean, R. S., & Mellinger, A. E. (1994). Factors underlying distance learner satisfaction with televised college level courses. *American Journal of Distance Education*, 8(1), 60-71.
- Blue River Basins Survey. 1996. *Big Blue/Little Blue River Basin Farming Practices Survey*. Lincoln: Nebraska Department of Agriculture, Division of Agricultural Statistics.
- Blum, A. (1996). *The teaching and learning in agriculture: A guide for agriculture teachers*. Rome: Food and Agriculture Organization of the United Nations.
- Boohar, J. A., Hoy, C. G., & Jelinek, F. J. (1996, May). *Water resources data: Nebraska, Water Year 1995*. USGS Water-Data Report NE-95-1. Lincoln, NE: U.S. Geological Survey, Water Resources Division.
- Borger, R., & Seaborne, A. E. M. (1982). *The psychology of learning*. Harmondsworth, Middlesex, England, Penguin Books,
- Brown, B. L. (1998). Using problem solving approaches in vocational education (pp. 4-5). ERIC Practice Application Briefs. Retrieved 9/21/05, from <http://ericcaceve.org/docs/prob-pab-pab.htm>
- Brown, J. W., Lewis, R. B., & Harcleroad, F. F. (1977). *Av instruction: media and methods*. New York: McGraw-Hill.
- Bruce, G. (2003). *Water quality impacts informing systems of the Midwest*. Austin: University of Texas Press, Center for Research in Water Resources.
- Bruening T., & Martin R. A. (1992). Farmer perceptions of soil and water conservation issues: Implications to agricultural and extension education. *Journal of Agricultural Education*, 33(4), 48-54.
- Bruening, T. H., Radhakrishna, R. B., & Rollins, T. J. (1992). Environmental issues: Farmers' perceptions about usefulness of informational and organizational sources. *Journal of Agricultural Education*, 33(2), 34-42.
- Brundage, D. H., & Macheracher, D. (1980). *Adult learning principles and their application to program planning*. Ontario, Canada: Ministry of Education.

- Burge, T. (1986). Individualism and psychology. *Philosophical Review*, 95, 3-45.
- Burns, R. W., (Ed.). (1964). *Sociological backgrounds of adult education*. New York: Syracuse University.
- Burton, W. H. (1963). Basic principles in a good teaching learning situation. In L.D Crow & A. Crow (Eds.), *Reading in human learning* (pp. 7-19). New York: McKay.
- CNAA. (1988). Credit Accumulation and transfer. *Information Services Digest*, 1(1), t.
- Career Clusters. (2002). *Career cluster resource for agriculture, food and natural resources*. Retrieved 11/6/2005, from http://www.careercluster.org.Cde.co.us/index_stdex_stdnd.htm
- Carkhuff, R. R. (1969). *Helping human relations: A primer from lay and professional helper*. New York: Holt, Rinehart, & Winston.
- Cell, E. (1982). *Learning to learn from experience*. Albany: State University of New York Press.
- Chaplin, M. F. (1998). Bile acids, fiber and colon cancer: the story unfolds. *Journal of the Royal Society of Health*, 118, 53-61.
- Chickering, A. W., & Gamson Z. F. (Ed.). (1991). *Applying the seven principles for good practice in undergraduate education*. San Francisco: Jossey-Bass.
- Clark, R. M., & Clark, D. A. (1995). *Drinking water quality management*. Lancaster, PA: Technomic Pub.
- Colorado Department of Education. (2001). *State content standards for agriculture education*. Retrieved 11/11/2005, from http://www.cde.state.co.us/index_stdnd.htm
- Coombs, P., & Ahmed, M. (1974). *Attacking rural poverty: How non formal education can help*. Baltimore: John Hopkins University Press.
- Cox, D., Lawver, D. E., Baker, M., & Doerfert, D. (2005). Critical water related curriculum needs as perceived by agricultural science teachers in programs located within the boundaries of the Ogallala aquifer. Wyoming Vocational Agricultural Teacher Association.
- Crow, L. D, & Crow, A. (Eds). (1963). *Reading in human learning*. New York: McKay.
- Culp III., K. (1997). Motivating and retaining adult volunteer 4-H leaders. *Journal of Agricultural Education*, 38(2), 1-7.

- Dale, D. D., & Somersan, A. (1992). *Public issues education: The cooperative extension system's role in addressing public issues*. Madison: University of Wisconsin Extension, in cooperation with Extension Committee on Organization and Policy.
- Dave, R. H. (1973). Characteristics of lifelong learning. In K. P. Cross (Ed), *Adults as learners: Increasing participation and facilitating learning* (pp. 261-263). San Francisco: Jossey-Bass.
- Davis, S & Stanley M.B (1994). *The monster under the bed: How business is mastering the opportunity of knowledge for profit*.
- Delors, J & Associates. (1997). *Learning: The treasure within*. Paris: UNESCO, International Commission on Education for the Twenty-first Century.
- Dewey, J. (1916). *Democracy and education*. New York: The Free Press.
- Dewey, J. (1938, 1963). *Experience and education*. New York: Collier.
- Dewey, 1938; Kolb, 1984; Juch, 1983. Retrieved 9/7/2005, from:
<http://reviewing.co.uk/research/learning.cycles.htm>
- Dewey, J. (1938). *Experience and education*. New York: Macmillan.
- D'Itri, F. M. & Wolfson, L.G. (1987). *Rural Groundwater Contamination*. Chelsea, MI: Lewis Publishers.
- Dollisso, A. D & Martin, R. A. (1999). Perceptions regarding adult learners motivation to participate in educational programs. *Journal of Agricultural Education*, 4(4), 38-46.
- Education and wealth of nations. (1997, March 29). *The Economist*, pp. 15-16.
- EPA (Environment Protection Agency). (1990). *Nonpoint source pollution: The nation's largest water quality problem*. Retrieved 9/24/2005, from
<http://www.epa.gov.OWOW/NPS?facts?point1.htm>
- Erikson, E. H. (1963). *Childhood and society* (2nd ed.). New York: Horton.
- Etzioni, A. (1961). *A comparative analysis of complex organizations: On power, involvement, and their correlates* New York: Free Press.
- Evans, D. (1967). The effects of achievement motivation and ability upon discovery learning and accompanying incidental learning under two conditions of incentives set. *Journal of Educational Research*, 60(5), 195-200.
- Fauve, E., Herrera, F., Kaddoura, A., Lopes, H., Petrovsky, A. J., Rahnema, M., & Ward, F. C. (1972). *Learning to be: The world of education today and tomorrow*. Paris: UNESCO.

- Ferrier, F. (1992). Not more of the same stuff: Student dissatisfaction with postgraduate courses. In M. S. Parer (Ed.), *Research and development in higher education*. Vol. 15 (pp. 381-387). Churchill, Victoria: HERDSA.
- Festinger L. (1954). A theory of social comparison. *Processes Human Relations*, 7, 117-140.
- Fliegel, F. (1984). Extension communication and adoption process. In E. B. Swanson (Ed.), *Agricultural extension: A reference manual*. Rome: Food and Agricultural Organization of the United Nations.
- Fodor, J. (1980). Methodological solipnism considered as research strategy. *Behavioral and Brain Sciences*, 3, 63-110.
- Frankforter, J. D. (1994.). *Compilation of atrazine and selected herbicide data from previous surface water quality investigations within the Big Blue River Basin, NE, 1983-1992*. U.S. Geological Survey Open File Report, 94-100.
- Freire, P. (1972/2002). *Pedagogy of the oppressed*. New York: Oxford University Press.
- Freire, P., & Shor. L (1973). *Education for critical consciousness*. New York: Continuum.
- Free Dictionary by Farlex. (n.d.). Retrieved 3/2006, from <http://www.thefreedictionary.com/water>
- Freshwater Foundation. (1987). *Agricultural chemicals and groundwater protection: Suggested direction for consideration and action*. Recommendations for the Conference on Agricultural Chemical and Groundwater Protection: Emerging Management and Policy. Navarre, MN: EPA.
- Fromm, E. (1900). *Man for himself*. London: Routedge and Kegan. Stuttgart : Diana Vlg., 1954
- Fromm , E (1941). *Scape from freedom*. New York, Rinehart
- Gardner, R.W., & Moriarty, A. (1968). *Personality development at preadolescence*. Seattle: University of Washington Press.
- Gehlhar, M., Thomas, J. D., & Vollrath, L. (1997). *U.S. export performance in agricultural markets*. Washington, DC: U.S. Dept. Of Agriculture, ERS.
- Gibson, J. J., & Spelke, L.A (1966). *The senses considered as perceptual systems*. Boston: Houghton & Mifflin.
- Giebink, B. (2003). *Water quality impacts in farming systems of the Midwest*. Urbana: University of Illinois Press.

- Greissler, H. G., Buffart, H. F. J. M., Leevwenberg, E. L. J., & Sarris, V. (1983). *Modern issues in perception*. Amsterdam, The Netherlands: North Holland.
- Grubb, W. N. (1996). *Working in the middle: Strengthening education and training for the mid-skilled labor force*. San Francisco: Jossey-Bass.
- Guru, M. V & Horne, J. E. (2000). *The Ogallala Aquifer*. Retrieved 9/29/2005, from <http://kerrcenter.com/RDPP/Ogallala2.htm>
- Hall, C. A. (1965). *Why Illinois women participate in home economics extension club programs*. University of Chicago.
- Hallberg, G. R. (1986). *Nitrates in groundwater in Iowa*. Proceedings of the Nitrogen and Groundwater Conference, Ames, Iowa Fertilizer and Chemical Association.
- Halliday, T. R & Slater, P. J. B. (Eds.). (1983). Animal behavior. Vol. 3. *Gene Development learning* (32-35). New York: Will-Freeman.
- Hebb, D. O. (1969). *The organization of behavior*. New York: John Wiley and Sons.
- Hentschel, U., Smith, G., & Draguns, J. G. (1986). Subliminal perception, microgenesis and personality. In U. Hentschel, G. Smith, & J. G. Draguns (Eds.), *The roots of perception*. New York: Elsevier Science Publishing Company, Inc.
- Higgins, E. T., & Kruglanski, A. W. (2000). Motivational science: The nature and functions of wanting. In E. T. Higgins & A. W. Kruglanski (Eds.), *Motivational science: Social and personality perspectives* (pp. 1–20). Philadelphia: Psychology Press.
- Hill, C. C. (1979). *Problem solving: Learning and teaching*. New York: Frances Pinter.
- Hilgard, R. R., & Atkinson, R. C. (1967). *Introduction to psychology* (3rd ed.). New York: Harcourt, Brace, and World, Inc.
- Holzkamp, K.. (1973). *Wissenschaft als handlung. Versuch einer neuen Grundlegung der Wissenschaftslehre*. Berlin: de Gruyter. [Transl. Knowledge, Theory of Science , edited in intro, by J. Berg. Translated from German by Burnham Terrel. Boston: D. Reidel Publishing Co.
- Homans, G. C. (1958). Social behavior as exchange. *American Journal of Sociology*, 63, pp. 25-27.
- Maier ,Horman, R. F. (1963). *Problem-solving discussions and conferences*. New York: McGraw-Hill.
- Hubler, E. (1999, January 3). The new faces of retirement. *New York Times*, Sec. 3 pp. 1, 12.

- Istance, D., Schuetze, H. G., & Schuller, T. (2002). *International Perspectives on long life learning from recurrent education to the knowledge society*. Buckingham, U.K.: Open University Press.
- Jarvis, P. (1987). *Adult learning in the social context*. London, U.K.: Croom Helm.
- Jayaratne, S. U. K. (2001). *Agricultural extension educators' perceptions regarding the teaching and learning process as related to sustainable agriculture: Implications for agricultural extension education*. Doctoral dissertation, Iowa State University, Ames.
- Joint Council on food and Agriculture. (1990). *Fiscal year 1992 priorities for research extension and higher education*. Washington, DC: U.S. Government Printing House.
- Juch, A. (1983). *Personal development: Theory and practice in management training*. New York: Wiley.
- Judy, R. W., & D'Amico, C. (1997). *Workforce 2020: Work and workers in the 21st century*. Indianapolis, IN: Huston Institute.
- Jung, C. G. (1971). *Psychological types*. Princeton, NJ: Princeton University Press.
- Kansas Department of Education. (1999). *Environmental education standards for Kansas*. Retrieved 11/6/2005, from http://www.ksbe.state.ks.us/outcomes/env_ed_stds.html
- Kaplowitz, M. D., & Kerr, J. (2003). Michigan residents' perceptions of wetlands and mitigation. *Wetlands*, 23(2), 267-277.
- Katz, D. & Kahn, R. L. (1966). *The social psychology of organization*. New York: Wiley.
- Keeton, M. T. (1997, March 5). Testimony at the Commission for a National of Lifelong Learners Forum on Demographic Trends. Dallas, TX.
- Keeton, M. & Tate, P. (1978). *Learning by experience: What, why, how*. San Francisco: Jossey Bass.
- Knoll, H. J. (1985). *Motivation for adult education: Working papers presented to the European Conference on Motivation for Adult Education*. New York: Saur.
- Knowles, M. S. (1980). *The modern practice of adult education from pedagogy and andragogy* (2nd ed.). New York: Cambridge.
- Kolb, D. A. (1984). *Experiential learning*. Englewood Cliffs, NJ: Prentice Hall.
- Krauss, S., Whitbourne, & Comilda, S. Weinstock. (1979). *Adult development differentiation of experience*. New York: Holt, Rinehart, & Winston.

- Krejcie, R. V., & Morghan, D. W. (1970). *Determining sample size for research activities. Educational and Psychological Measurement* 30, 607-610.
- Lancaster, H. (1997, March 11) Companies promise to help employees plot their careers. *Wall Street Journal*, sec. 2, p. 1.
- Lawler III, E. E. (1967). The multitrait approach to measuring managerial job performance. *Journal of Applied Psychology*, 51, 369-381.
- Leonard, N. H., Beauvais, L. L., & Scholl, R. W. (1999). Work motivation: The incorporation of self-concept-based processes. *Human Relations*, 52, 969-998.
- Lichenberg, E., & Zimmerman, R. (1999). Adverse health experiences, environmental attitudes, and pesticide usage behavior of farm operators. *Risk Analysis*, 19(2): 283-294.
- Lindeman, E. (1988). Preparing leaders in adult education. In S. Brookfield (Ed.), *Training educators of adults* (pp. 93-97). London, U.K.: Routledge.
- Lionberger, H. F., & Gwin, P. G. (1982). *Communication strategies: A guide for agricultural Education*. Danville: Interstate Printers and Publishers, Inc.
- Longworth, N., & Davies, W. K. (1996). *Lifelong learning: New vision, new implications, new roles for people, organizations, nations and communities in the 21st century*. London, U.K.: Kogan Page.
- Lovell, R. B. (1980). *Adult learning*. London: Croom Helm Halsted Press.
- Luckner, J., & Nadler, R. (1999). Sabre Corporate Development Site Map Web design by Daryl Chambers © Sabre Corporate Development, 2002. Retrieved 9/16/2005, from <http://www.sabrehq.com>
- Lumber, W., & Gardiner, S. (1987). *The ubiquitous chip: The human impact of electronic technology*. Quebec, Canada: Hudson Heights.
- Lynton, E. H. (1984). *The missing connection between business and the universities*. New York: MacMillan.
- Mahrotra, M. C. (2001). *Distance learning, Principles for effective design, delivery and evaluation*. Thousand Oaks, CA: Sage.
- Marisol, E. (2000). *Learning from change: Issues and experiences in participatory monitoring and evaluation*. London, U.K.: Intermediate Technology Publications.
- Marshall, M. G., & Bennett, C. F. (1998). *National extension target water quality program, 1992- 1995*. Washington, DC. Cooperative State Research, Education and Extension Service, U.S. Department of Agriculture.

- Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, 50, 370-396.
- McClelland, D. D., Atkinson, J. W., Clark, R. A., & Lowell, E. L. (1953). *The achievement motive*. New York: Appleton-Century-Crofts.
- McDonald, D. C., Miller, C. A., & Steward, W. P. (2003). *Public attitudes toward open space initiatives in Illinois*. Springfield: Report to the Illinois Department of Natural Resources.
- Maehl, William.(1999). *Lifelong leaving at its best: innovative practices in adult credit programs*. Foreword by Horton Bahr. New York: Jossey-Bass
- Merriam, S. B., & Caffarella, R. S. (1999). *Learning in adulthood: A comprehensive guide* (2nd ed.). San Francisco: Jossey-Bass.
- Miller, R. B. (1953). *Handbook on training and training equipment design*. WADC, Tech. Report, 53-136. U.S. Air Force.
- Miller, L. E., & Smith, K. L. (1983). Handling non-response issues. *Journal of Extension*, 21, 45-50.
- Napier, T. L., & Trucker, M.. (2001). Use of soil and water protection practices and farmers in three Midwest watersheds. *Environmental Management*, 27(2), 269-279.
- National Center for Education Statistics. (1998). *Digest of education statistics, 1997* (DED, OERI Publication No. 98.015). Washington, DC: U.S. Government Printing Office.
- The National Extension Targeted Water Quality Program. (1992-1995). Retrieved 1/24/2005, from <http://www.worldcatlibraries.org/wcpa/top3mset/12470bbaf60dd991a19afeb4da09e526.html>
- National Public Policy Education Committee. (1994). Retrieved 1/22/2005, from <http://www.farmfoundation.org>
- National Water Quality Monitoring Council. (N.W.Q.M.C). U.S. Department of Interior, US. Geological Survey. Retrieved 03/2005, from <http://water.usgs.gov/wicp/acwi/monitoring>
- Nebraska Department of Education. (1999). *Nebraska agricultural education essential learning*. Retrieved 11/6/2005, from <http://www.nde.state.ne.us/HEALTH/LEARNS/6Ag%20Links%20to%20Learn.pdf>
- Neisser, M. (1967). *Cognitive psychology*. New York: Appleton-Century-Crofts.
- Newsharn, D. B. (1969). *The challenge of change to the adult trainee*. Training Information Pamphlet, no. 3. London, U.K.: HMSO.

- Nicholas, C. (2002). *Learning to teach adults*. RoutledgeFalmer, 11 New Fetter Lane, London, EC4P4.
- Nickerson, R. S., & Zidhiates, P. P. (1988). *Technology in education: Looking toward 2020*. Hillsdale, NJ: Erlbaum.
- North Plains Groundwater District. (n.d). *The Ogallala Aquifer in the North Plains Groundwater District*. Oklahoma Department of Career and Technology Education. Retrieved 9/11/2005, from <http://www.npwd.org/index.htm>
- Oklahoma Department of Career and Technology Education. (n.d.). *Oklahoma agricultural education ...It's what you need*. Retrieved 11/6/2005, from http://www.okcareertech.org/aged/ag_ed_general_overview.htm
- Organizations for Economic Cooperation and Development, OECD. (1999). *Overcoming Exclusion through Adult Learning*. Paris: OECD Publications.
- Padgitt, S. (1987). *Agriculture and groundwater issues in big spring Basin and Winneshiek county, Iowa survey of farm and non farm households on perceptions, attitudes, and farming practices*. Ames: Iowa State University Cooperative Extension Services.
- Perkins, J. (1997, March 13). Testimony at the Commission for National of Lifelong Learners. Chicago: Forum on the Economy.
- Pick, A. D. (1979). *Perception and its development: A tribute to Eleanor J. Gibson*. Hillsdale, NJ: Erlbaum & Associates.
- Pittenger, O. E., & Gooding, C. T. (1971). *Learning theories in educational practice: An introduction of psychological theory and educational psychology*. New York: John Wiley & Sons, Inc.
- Pittman, T. S. (1998). Motivation. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *Handbook of social psychology, 1* (pp. 549-590). New York: McGraw-Hill.
- Plomin, R. (1990). *Behavioral genetics: a primer*. New York: W. H. Freeman.
- Power, J. F., Flowerday, A. D., Wiese, R. A., & Watts, D. G. (1998). Agricultural nitrogen management to protect water quality. Washington, DC: Bull. 4. *USDA-CREES-IDEA*.
- President's Focus Groups. (1997, February 11). Discussion on the future of lifelong learning at the Commission for a Nation of Lifelong Learning Focus Group of College and University Presidents. Washington, DC: Author.
- Prinz, W. (1993). Looking at some new look problems from an information processing point of view. In U. Hentschel, G. Smith, & J.G. Draguns (Eds.). *The roots of perception* (pp. 419-426). New York: Elsevier Science Publishing Company, Inc.

- Prisuta, R. (1997, March 5). Testimony at the Commission for a National of Lifelong Learners Fom on Demographic Trends. Dallas, TX.
- Reeves, H. C., & Ellsworth, S. (1984). *Funding clean water*. Lexington, MA: Lexington Books.
- Rock, I. (1983). *The logic of perception*. Cambridge, MA: MIT Press.
- Rogers, C. (1983). *Freedom to learn for the 80's*. Columbus, OH: Penguin Books.
- Romiszowski, A. J.(1970). Systems approach to education and training: An introduction. In A. J. Romiszowski (Ed.), *Systems approach to education and training* (pp. 11-21). London, U.K.: Kogan Page.
- Royce, J. R. (1974). Cognition and knowledge: Psychological epistemology. In E. C. Caterette & M. P. Friedman (Eds.), *Handbook of perception, vol. 1* (pp. 149-176). New York: Academic Press.
- Salisbury, D. F. (1996). *Five technologies for educational change*. Englewood Cliffs, NJ: Educational Technology.
- Scheibel, J. (1997, March 5). Testimony at the Commission for a Nation of Lifelong Learners Forum on Demographic Trends. Dallas, TX.
- Schmuck, R., Chesler, M., & Lippitt, R. (1966). *Problem solving to improve classroom learning*. Chicago: Science Research Association.
- Shor, I., & Freire, P. (1987). *A pedagogy for liberation: Dialogues on transforming education*. South Hadley, MA: Bergin and Garvey.
- Silvern. L. C. (1968). Systems approach: What is it? *Educational Technology*, 8(16), 5-6.
- Smith, G., & Westerlundh, B. (1980). Percept genesis: A process perspective on perception personality. In L. Wheeler (Ed.), *Review of personality and Social Psychology* (94-124.). Beverly Hills, CA: Sage.
- Solley, C. M., & Murphy, G. (1960). *Development of the perceptual world*. New York: Basic Books.
- South Dakota Agricultural Education/FFA/PAS. (n.d). *Agricultural education/agriscience competency profile*. Retrieved 11/6/2005, from <http://www.dwcp.org/grey/competencyprofiles2.xls>
- Southern perspectives SRDC (Southern Rural Development Center. (1999). EPA and USDA, Vol. 1, No. 3, Retrieved 11/6/2005, from <http://srdc.msstate.edu/publications/newsletter.htm>

- Stepien, W. J & Gallagher, S. A. (1993). Problem-based learning: As authentic as it gets. *Educational Leadership*, 50, (7), (April), 25-28.
- Stock, A, K. (1979). Developing lifelong education: Post school perspectives. In A. J. Cropley (Ed), *Lifelong education: A stocktaking*. Hamburg :UNESCO, Institute for Education. UIE Monograph, No. 8.
- Stubblefield, H. W. (1988). *Toward a history of adult education in America: The search for a unifying principle*. London, U.K.: Croom Helm.
- Stubblefield, H. W., & Keane, P. (1994). *Adult education in the American experience: From the colonial period to the present*. San Francisco: Jossey-Bass.
- Swanson, B. E. (Ed.). (1984). *Agricultural extension: A reference manual*. Rome: Food and Agriculture Organization of the United Nations.
- Teamskills training (n.d.) . Retrieved 11/6/2005, from.
http://www.strictlysuccess.com/program_motivation.html
- Tough T. (1971). *The adult's learning projects: A fresh approach to theory and practice in adult learning*. Toronto, Ontario: Institute for Studies in Education.
- Tennant, M., & Pogson, P. (1995). *Learning and change in the adult years*. San Francisco: Jossey-Bass.
- Texas Education Agency. (1998). *Texas essential knowledge and skills for agricultural science and technology education*. Retrieved 11/6/2005, from
<http://www.tea.state.tx.us/rules/tac/chapter119/ch119c.htm>
- Thomson, H. A., (1970), comparison of predictor and criterion judgments of managerial performance using the multitrait-multimethod approach. *Journal of Applied Psychology*, 54, 496-502.
- Torrance, P. (2000). *Future problem solving: Opening doors to the future*. Retrieved 9/15/2005, from <http://www.fpsp.org>
- Trout, J. (2004). *On strategy: Capturing mindshare conquering markets*. New York: McGraw-Hill.
- Tuckman, B. W. (1978). *Conducting educational research*. New York: Harcourt Brace Javanovich, Inc.
- UNESCO (1998): Conference report on lifelong learning and adult learning concern Australian University. Published by Public Affair Division. Retrieved 03/04/2005, from http://info.anu.edu.au/mac/Publications/ANU_Annual_Reports/_98arweb.pdf
- U.S. Department of Agriculture. (1992, September). Agriculture and social impact.

- U.S. Department of Agriculture Extension Service. (1988). *Cooperative extension system national initiatives: Focus on Issues*. Washington, DC: United States Department of Agriculture.
- USDA-CSREES. (2003-2004). National Water Quality Conference. Ames, IA.
- U.S. Geological Survey Geology Dictionary. (2004). Retrieved 11/6/2005, from <http://geology.com/dictionary/glossary-w.shtml>
- Vanclay, F., & Bronstein, D. A. (1995). *Environmental and social impact assessment*. New York: J. Wiley.
- Verchick, R. R. (1999). Dust bowl blues: Saving and sharing the Ogallala Aquifer. *Journal of Environmental Law and Litigation*, 14(1), 13-23.
- Verduin, Jr., J. R., Miller, H. G., & Greer, C. E. (1977). *Adults teaching adults principles and strategies*. Austin, TX: Learning Concepts, Inc.
- Verduin, J. R., & McEwen, D. N. (1984). *Adults and their leisure: the need for lifelong learning*. Springfield, IL: C. C. Thomas.
- Verner, C. (1964). Definition of terms. In G. Jensen, A. A. Liveright, & W. Hallenbeck (Eds.), *Adult education: Outlines of an emerging field of University study*. Washington, DC: Adult Education Association of the U.S.A.
- Vernon, M. D. (1970). *Perception through experience*. London, U.K.: Methuen.
- Walk, R. D., & Pick, Jr., H. L. (1978). *Perception and experience*. New York: Plenum Press.
- Warner, S., & McGill, I. (1989). *Making sense of experiential learning diversity in theory and practice* (1st ed.). London, U.K.: Open University Press.
- Water-Quality association for U.S.A. (2004). Retrieved 8/2005, from <http://waterdata.usgs.gov/nwis/qw>
- Whithbourne, S. K., & Weinstock, C. S. (1979). *Adult development: The differentiation of experience*. New York: Holt, Rinehart, and Winston.
- Wilding, J. M. (1983). *Perception: From sense to object*. New York: St. Martin's Press.
- Winterbottom, M. R. (1953). The relation of childhood training in independence achievement motivation. Cited in D.C. McClelland et al. (1975). *Power inner experience*. New York: Halsted Press.
- Witkin, H. A., Lewis, H. B., Hertzman, M., Machorer, K., Meissener, P. B., & Wapner, S. (1954). *Personality through perception*. New York: Harper and Row.

- Witkin, H. A., et al. (1969). *Psychological differentiation: Studies of development*. New York: Wiley.
- Witkin, B. R. (1984). *Assessing needs in educational and social programs*. San Francisco: Jossey-Bass Publishers,
- Wrightsman, L. S. (1988). *Personality and development in adulthood*. Thousand Oaks, CA: Sage.
- Wrightsman, L. S. (1994). *Adult personality development*. Thousand Oaks, CA: Sage.
- Wyoming Vocational Agricultural Teacher Association. (n.d.). *Wyoming agricultural education standards* Retrieved 11/6/2005, from http://ed.uwyo.edu/AgEd/resources/WY_Ag_Standards/main.html
- Zirkin, B. G., & Sumler, D. E. (1995). Interactive or non-interactive? That is the question! An annotated bibliography. *Journal of Distance Education*, 10(11), 95-112.
- Zoubek, G. (1997). *A baseline study to assess farm operator's practices and attitudes in the recharge lake basin drainage area*. Upper Big Blue Nature. University of Wisconsin Madison Land Tenure Center, USAID.
- Robert, B., & A.E.M. (1927). *The psychology of learning*. New York: Penguin Books. (1982)

ACKNOWLEDGMENTS

I am grateful to my major professor, Dr. Robert Martin, for his guidance throughout my program of study. I am especially thankful for his research support which enabled me to gain valuable experience in water quality leadership and issues in the United States. I am also grateful to Dr. Jim Baker for his continual advice and support regarding water quality issues in the North Central Region.

I am also thankful to my committee members, Drs. David Acker, Lorna Butler, Lynn Jones, and Steve Sapp for their support of my research. Special thanks to Dr. Mack Shelley for his review of the statistics and Anthony Stevens for his valuable suggestions regarding presentation of the data. I'm also thankful to Dr. Gerald Miller for helping me contact extension programs directors and staffs in the North Central Regional offices.

I am thankful for the friendship and assistance of fellow graduate students, Tami Camara, John Musemakweri and Moreetsi Tabala, and for their collaboration, long hours of discussion and assistance proofing of my English during the course of writing. I am also grateful to my editor, Pat Hahn, for her assistance in the final drafts.

Thanks to the Ministry of Education in Guinea-Conakry for allowing me to study abroad. I have a great love and respect for my cultural heritage that will be with me always.

Most importantly, I am thankful to my family members for their support and prayers throughout my studies. To my sisters and brothers, thank you for your companionship throughout my life and sharing my dreams and aspirations. To my parents, my father, Omar, and my mother, Fatima, for their love and belief in my ability to reach my goals. I am indebted to them especially for providing the rich background of my life that made me

inquisitive and adventurous to seek the means to achieve lifelong dreams. To my uncle, Kerfala Camara, who has loved me like a son after my father's passing 20 years ago. He listened to my boyhood dreams, helped me to mature as a man, and provided financial support to enable me to study at home and abroad. My success is also his success. To my daughter, E'mma Fatima Camara and her mom Julie Camara, I hope one day that you will have the courage and self motivation to follow your dreams like your dad.